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HOMELAND SECURITY
STUDIES & ANALYSIS INSTITUTE

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SBInet Independent Assessment: Analysis of Alternatives, Phase IB

Presented to:

SBInet AoA Executive Steering Committee (ESC)

Presenter:

(b)(6)(b)(7)(C), SBInet AoA Lead

26 January 2011

Outline

- **Introduction**
  - Background
  - Scope / Limitations
  - General Approach
  - Data and Assumptions
- **Alternatives**
- **Effectiveness Analysis**
- **Cost Analysis**
- **Summary**
- **Additional Topics**

Background

SBInet Reassessment

[Due] to my ongoing concerns about SBInet, I … ordered a departmentwide reassessment of the program to consider options that may more efficiently, effectively and economically meet our border security needs.

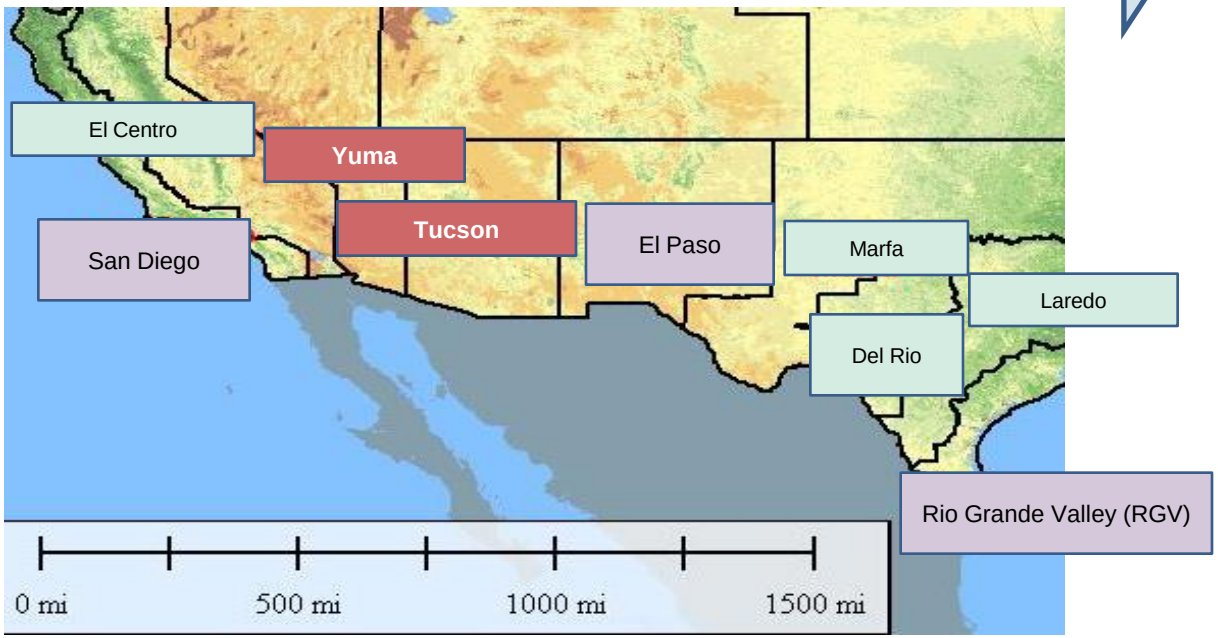
-- DHS Secretary Janet Napolitano, 15 Jan 10

- **The Department's reassessment considered two questions:**
  - *"Is the SBInet system viable?"*
    - Conducted system acceptance testing and Independent Operational Test and Evaluation (IOT&E) of Block1 deployments
  - *"If so, is it worth the cost?"*
    - Initiated a phased **Analysis of Alternatives (AoA)** to "measure the cost and operational effectiveness of…alternative technologies [to provide situational awareness] along the Southwest border." (SBInet AoA, Terms of Reference)

Background

AoA Phasing

- **AoA Phase IA Results**
  - Demonstrated that one size does not fit all (area-specific factors influence choice of technology)
  - Were used by OBP to develop a new Technology Deployment Plan for AZ



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Background

S1 Guidance for Phase IB

- **Consider a wider range of technologies / alternatives**
- **Obtain additional input from other agencies (e.g., Department of Defense)**
- **Seek validation by conducting an external peer review**

Background

Phase IB: What We Did

AoA Elements	Changes / Improvements (Phase IB vs IA)
Geographic Areas	• Analyzed three new sectors: San Diego (including maritime areas), El Paso, and RGV
Alternatives	• Added a new alternative (b) (7)(E)) • Explored a (b) (7)(E))
Operational Effectiveness Analysis	• Refined Phase IA Measures of Effectiveness (MOEs) – (b) (7)(E) – – – • Added two new MOEs – MOE 5: (b) (7)(E) – MOE 6: • Estimated the operational effectiveness of the technology baseline
Cost Analysis	• Reviewed, refined, adjusted, and updated all Phase IA cost data • Separately analyzed impact of changes to key inputs and model parameters
Cost-Effectiveness Comparisons	• Began MOE-based comparison of AoA results to Technology Deployment plan recommendations
Independent Review	• Convened an independent review team to assess both Phase IA and Phase IB analyses
Additional Topics	• Identified desirable characteristics for new system / technology solutions • Developed a proposed analysis framework for urban areas

Background

Additional Sources Consulted in Phase IB

- **Labs/Prototyping Divisions**
  - Los Alamos National Laboratory (LANL)
  - (b) (7)(E)
- **Other Think Tanks**
  - RAND
  - CNA
- **Program Managers**
  - (b) (7)(E)
- **Others**
  - USNORTHCOM
  - Naval Postgraduate School
  - OSD/ATL

Background

External Review

- **Independent Review Team (18-19 Jan 11)**
  - Reviewers
    - (b)(6);(b)(7)(C)
  - Major Findings
    - The SBInet AoA to date appears to have successfully answered the questions that were asked of it
    - The study does not exactly match all DoD definitions/criteria for an AoA per se; *however*,
      - This may be due largely to differences between DoD and DHS processes, systems, and needs
      - The analysis *was* systematic, analytically rigorous and scientifically repeatable
    - Given the analyses performed, the insights presented appear to be valid
- **OSD (ATL) and ASD (HD&ASA) reviews [pending]**

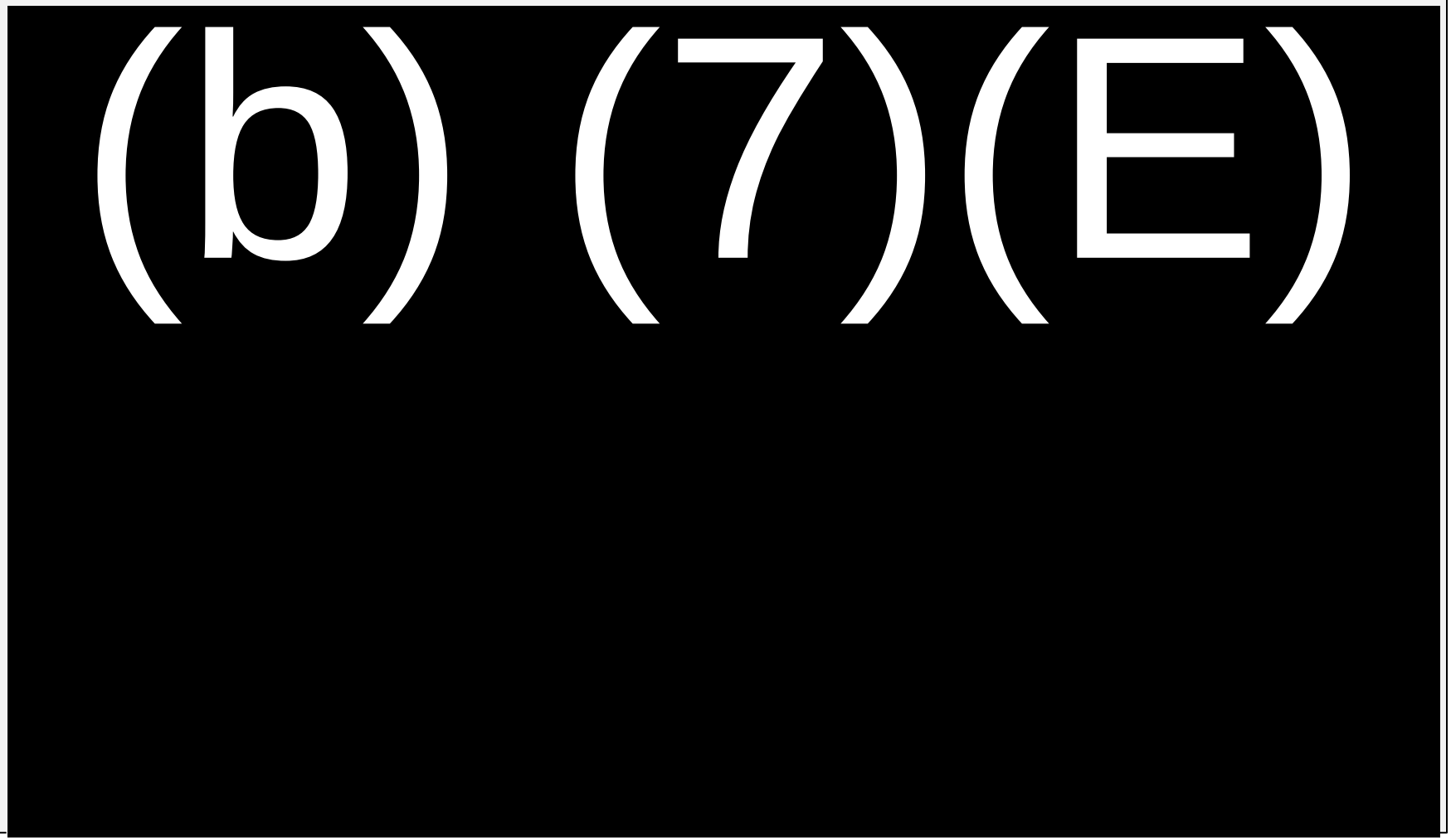
*The Office of Aerospace Studies (OAS) is the US Air Force Center of Expertise for Analysis of Alternatives (AoAs). OAS helps Air Force organizations plan and execute AoAs; teaches AoA courses; publishes the Air Force AoA Handbook; maintains an AoA library; and develops guidelines and standards for AoAs. OAS provides a technical assessment of all Air Force AoA study plans.

Scope

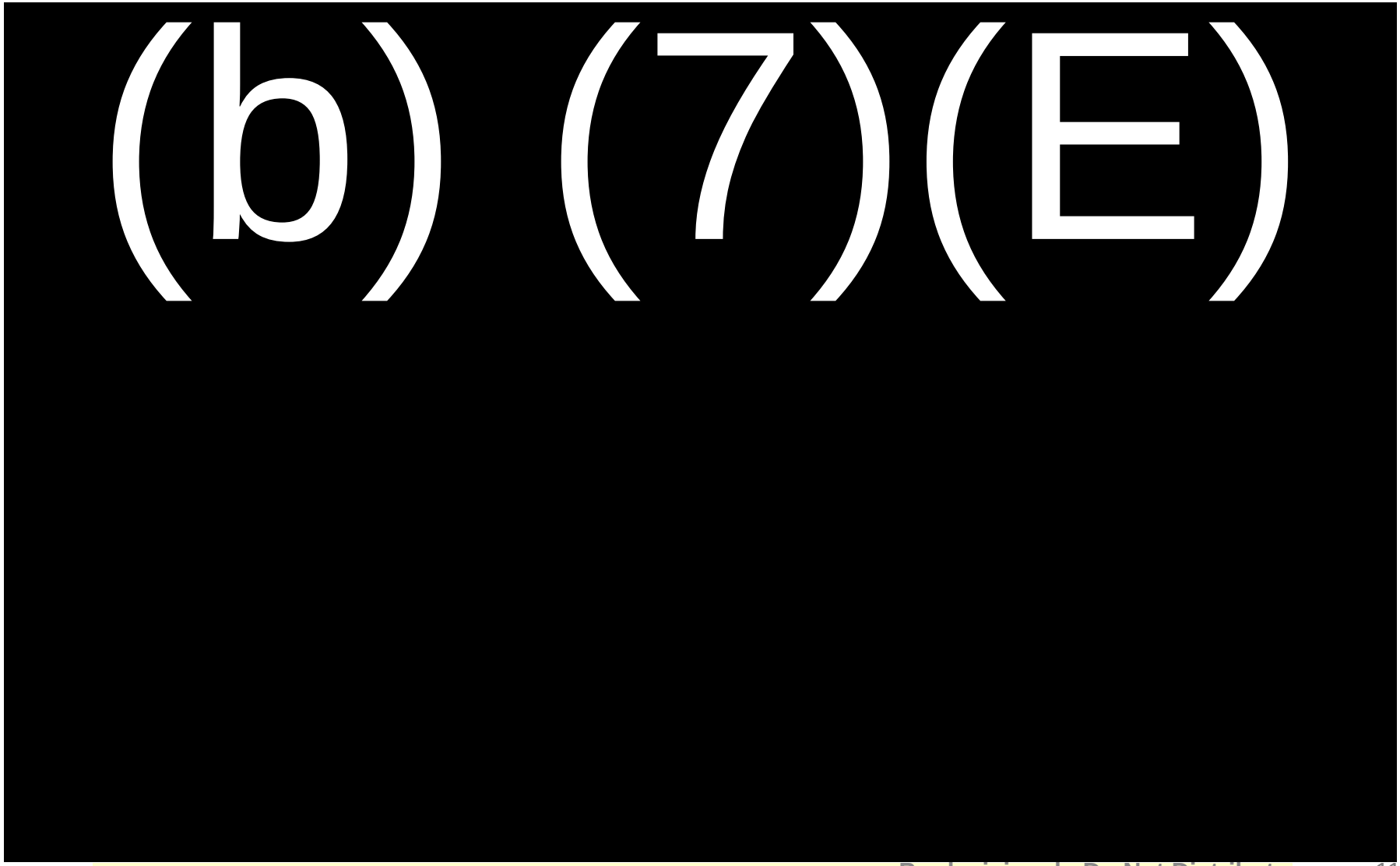
AoA Focus	Phase IA (complete)	Phase IB
Mission	Situational Awareness (vice apprehension, transportation, detention)	
Solution Component	Technology (vice personnel and tactical infrastructure)	
Geographic	• Tucson, Yuma	• San Diego, El Paso, RGV
Decision	• SBInet program, budget, and contract decisions	• Most appropriate technology alternatives
Time Horizon	• Systems in use, 2010 • Mature systems and technologies specified by DHS	• Systems deployable by 2013 • Wider range of systems and technologies identified by DHS and DoD

Limitations

- **The AoA *<u>does</u>*:**
- **The AoA *<u>does not</u>*:**



General Approach



Data Types and Sources

	Types	Sources
Technical Performance	(b) (7)(E)	
Cost		
Operations		
Environment		

(b) (7)(E)

USGS = US Geological Survey

DTED = Digital Terrain Elevation Data
DEM = Digital Elevation Model

Major Assumptions

- **Operations**
  - (b) (7)(E)
- **Threat**
  - (b) (7)(E)
- **Technology**
  - (b) (7)(E)

Outline

- **Introduction**
- **Alternatives**
  - What is an Alternative?
  - Five Alternatives
  - Variations, Mixes, Hybrids
  - Detailed Description of Alternatives
- **Effectiveness Analysis**
- **Cost Analysis**
- **Summary**
- **Additional Topics**

What is an Alternative?

- **An Alternative is a "technology approach"**
  - Platform-centric strategy (e.g., "from the air," "from fixed ground locations," etc.)
  - AoA Phase IB considers at least one example of each
- **Each Alternative**
  - Starts with the same baseline of existing personnel, tactical infrastructure, and equipment
  - *Adds* systems and operators, using one of five technology approaches, to address current gaps in situational awareness
  - Includes a high-level concept of employment that describes how information is collected and used

Five Alternatives

Alt 1: Agent-Centric	(b) (7)(E)
Alt 2: Fixed	
Alt 3: Ground-Mobile	
Alt 4: Aviation (UAS)	
Alt 5: Tethered Aerostat	

Variants, Mixes, Hybrids

	Definition	Example	Included?	
			Phase IA	Phase IB
Variants	(b) (7)(E)			
Mixes				
Hybrids				

(b) (7)(E)

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Baseline Assets

(b) (7)(E)

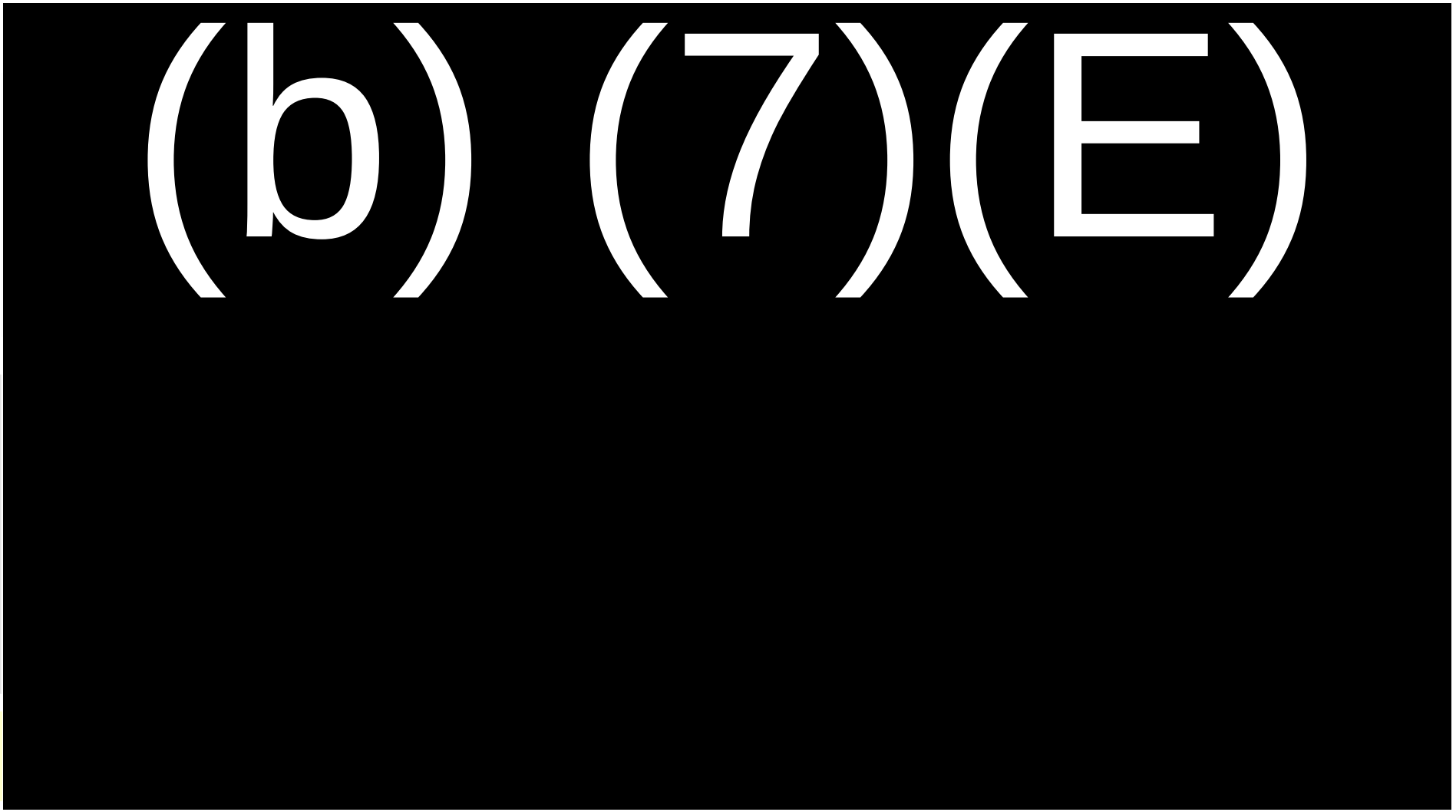
Alternative Asset Laydowns

(b) (7)(E)

(b) (7)(E)

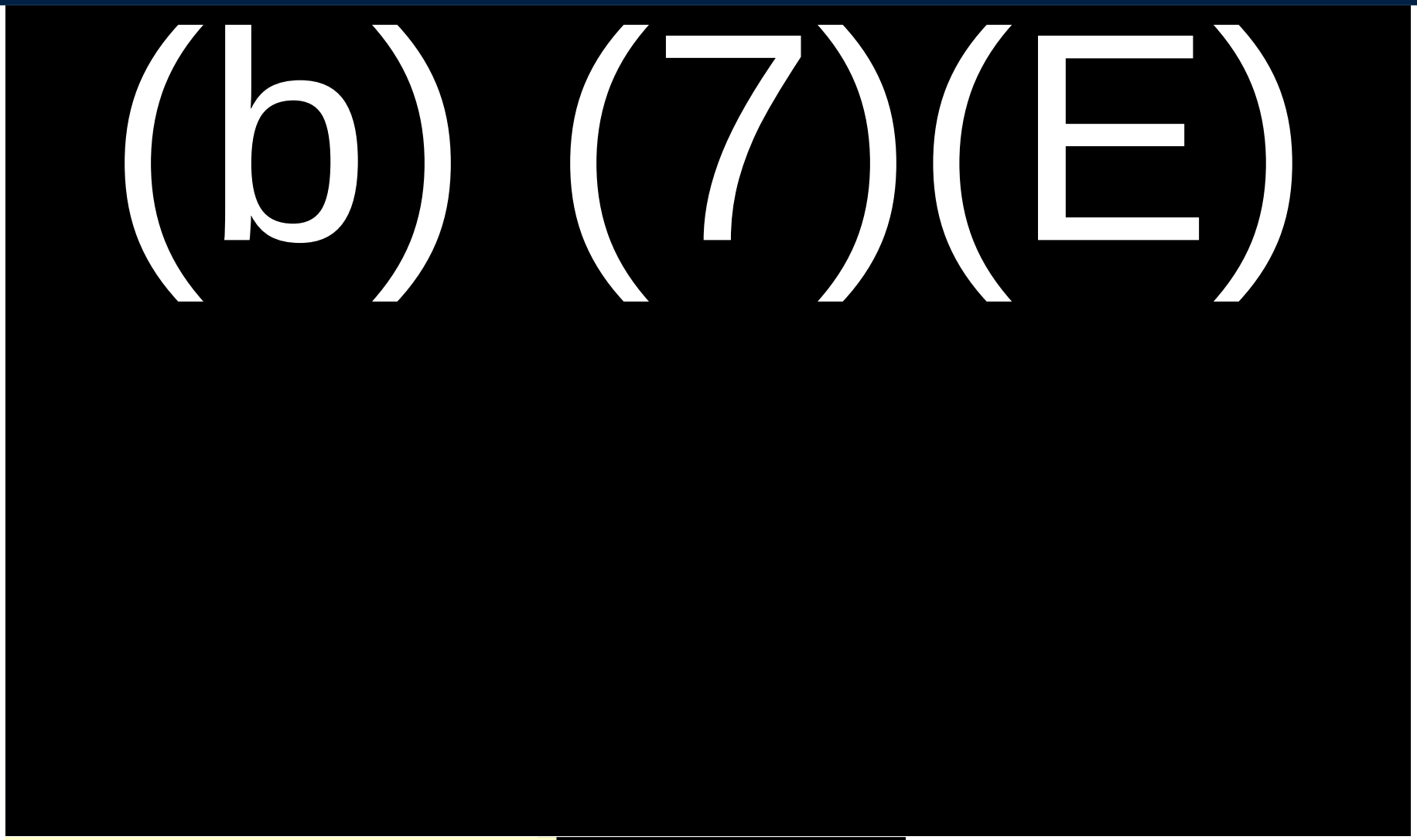
Alternative Asset Laydowns

(b) (7)(E)



Alternative Asset Laydowns

(b) (7)(E)



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Alternative Asset Laydowns

(b) (7)(E)

(b) (7)(E)

Alternative Asset Laydowns

(b) (7)(E)

(b) (7)(E)

Alternative Asset Laydowns

All Analysis Areas E-J; Alternative 4

Detailed Analysis Area	Alt 4 (Aviation-UAS)				
	Analysis area (mi^2)	Entire station AOR (mi^2)	Analysis area fraction of station AOR	UAS hr/day over entire station*	**UAS hr/day over analysis area**
(b) (7)(E)					

Alternatives: Systems Added

Detailed Analysis Area	Baseline	Alternatives				
		Alt 1 Agent-Centric	Alt 2 Fixed	Alt 3 Ground-Mobile	Alt 4 Aviation (UAS)	Alt 5 Aerostats
	(b) (7)(E)					
(b) (7)(E)						

(b) (7)(E)

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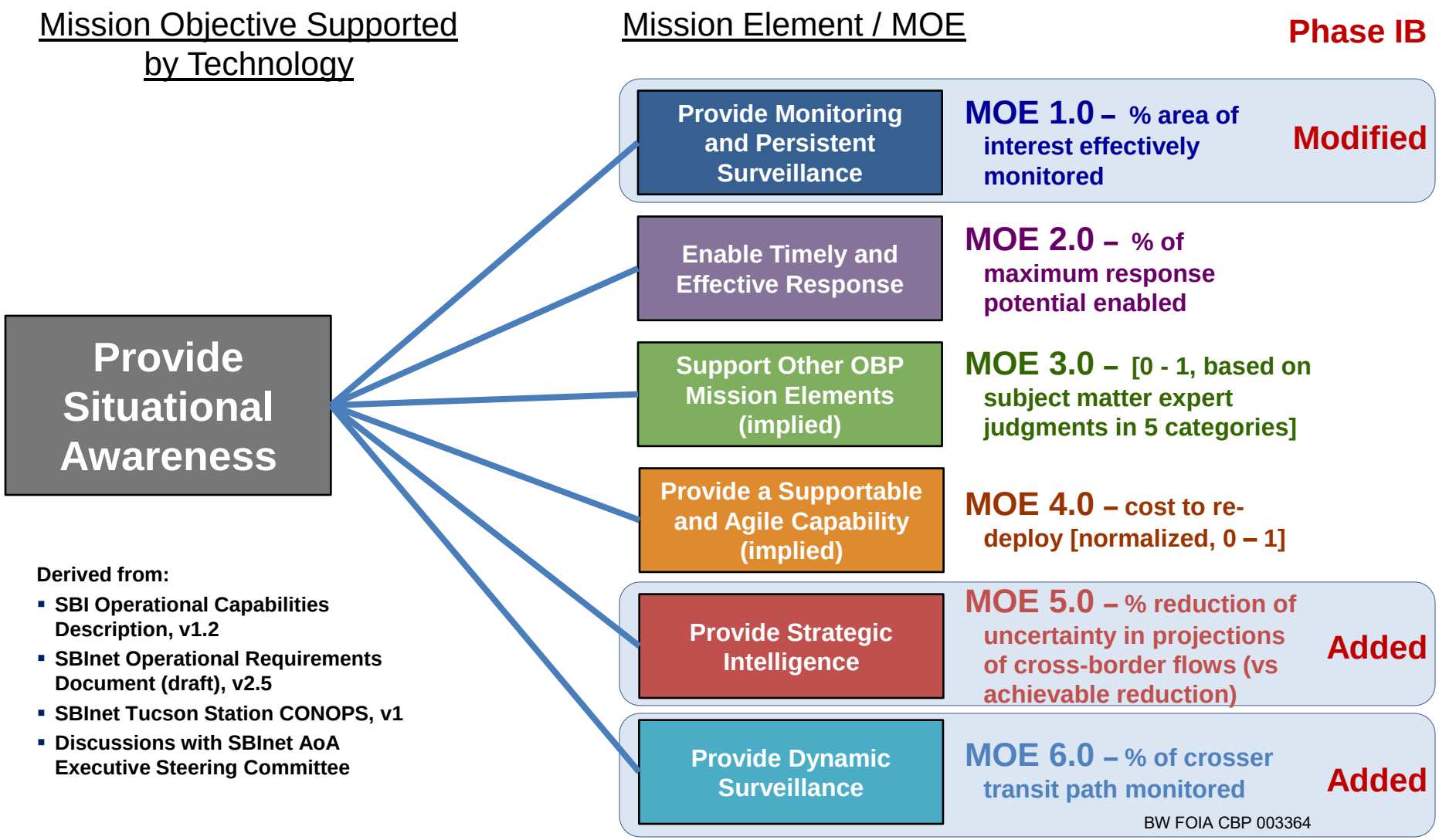
Outline

- **Introduction**
- **Alternatives**
- **Effectiveness Analysis**
  - Measures of Effectiveness
  - Inputs
  - Detailed Analysis Results
    - MOE 1.0
    - MOE 2.0
    - MOE 3.0
    - MOE 4.0
    - MOE 5.0
    - MOE 6.0
  - Summary & Observations
- **Cost Analysis**
- **Summary**
- **Additional Topics**

Measures of Effectiveness (MOEs)

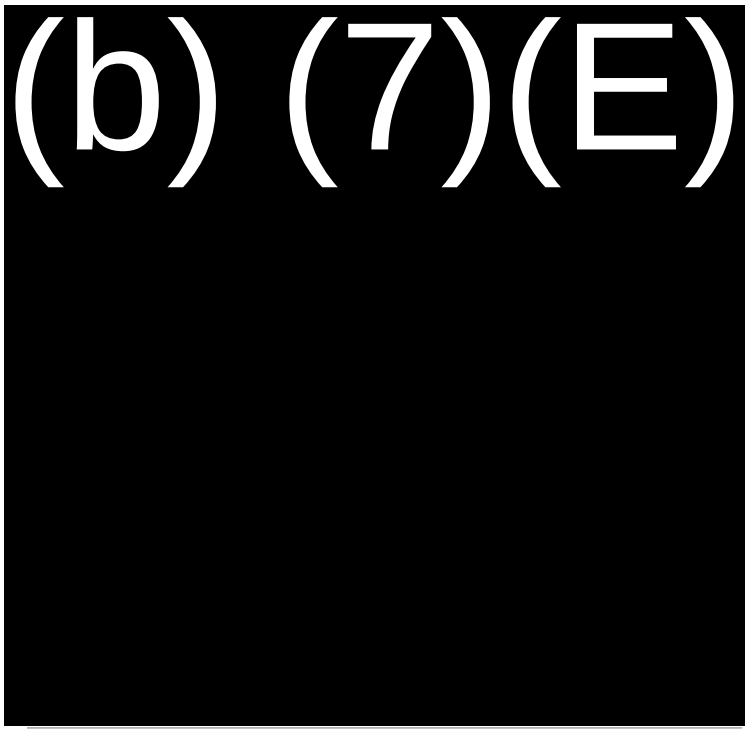


Derived from:

- **SBI Operational Capabilities Description, v1.2**
- **SBInet Operational Requirements Document (draft), v2.5**
- **SBInet Tucson Station CONOPS, v1**
- **Discussions with SBInet AoA Executive Steering Committee**

MOE Weights

- **With respect to the top-level objective of providing situational awareness:**



- MOE 1.0 - Monitoring and Persistent Surveillance
- MOE 2 - Enable Timely and Effective Response
- MOE 3 - Support Other OBP Mission Elements
- MOE 4.0 - Provide a Supportable and Agile Capability
- MOE 5.0 - Provide Strategic Intelligence
- MOE 6.0 - Provide Dynamic Surveillance

Source: derived from pooled pairwise judgments provided by OBP (SPPA/SWB/NCB/OIT), 18 Nov 10

Effectiveness Analysis: Inputs

	Parameter	Input Value	Source/Comment
(b) (7)(E)			

Effectiveness Analysis, Inputs (cont)

	Parameter	Input Value	Source/Comment
(b) (7)(E)			

Outline

- **Introduction**
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  - Inputs
  - Detailed Analysis Results
    - MOE 1.0
    - MOE 2.0
    - MOE 3.0
    - MOE 4.0
    - MOE 5.0
    - MOE 6.0
  - Summary & Observations
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- **Summary**
- **Additional Topics**

MOE 1
Provide Persistent Surveillance

(b) (7)(E)

MOE 1 = (b) (7)(E)

(b) (7)(E)

(b) (7)(E)

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MOE 1.0: Persistence

(b) (7)(E)

(b) (7)(E)

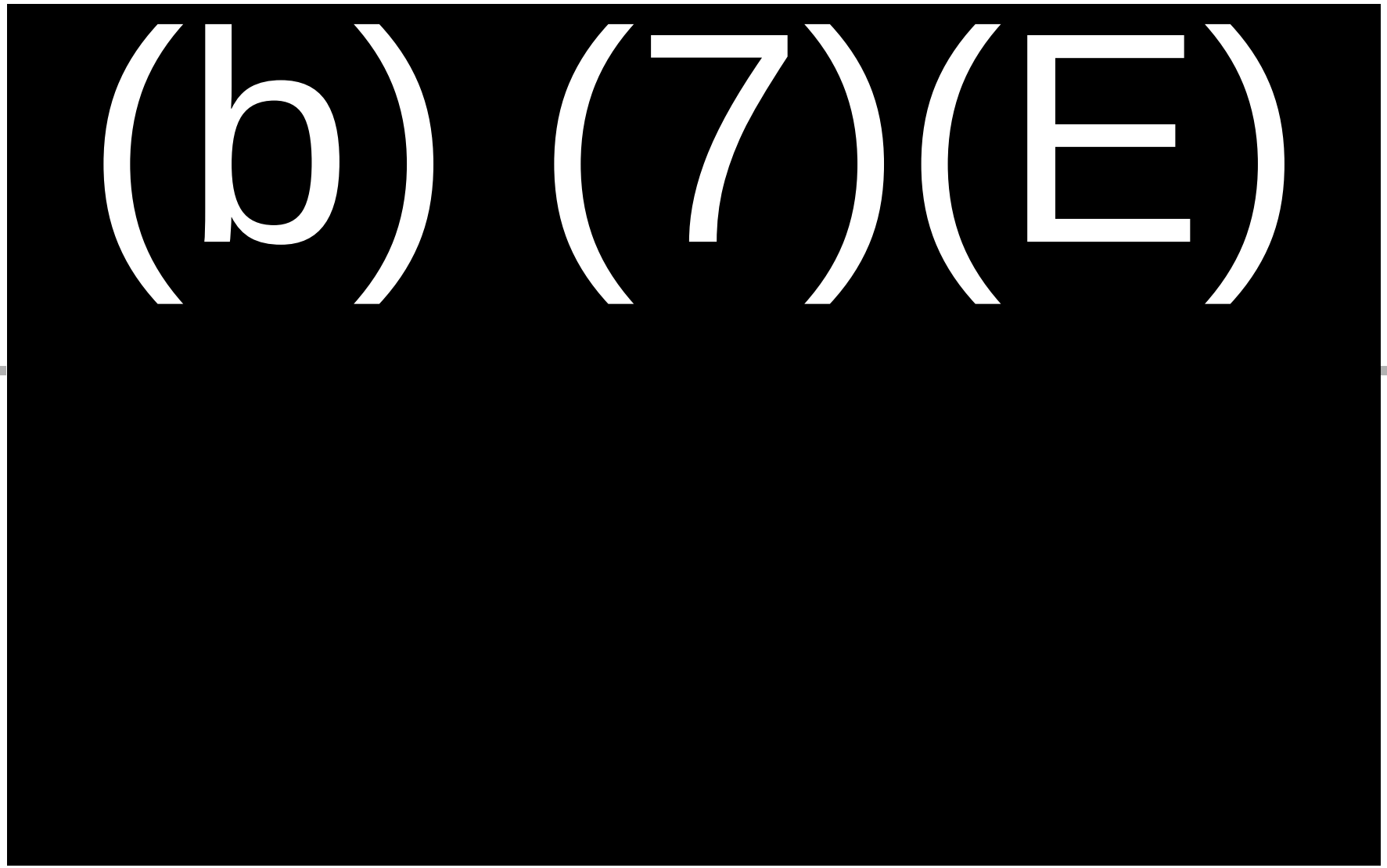
MOE 1.0: Coverage and Availability

(b) (7)(E)

(b) (7)(E)

MOE 1.0: Coverage and Performance

(b) (7)(E)



MOE 1.0: Coverage

All Analysis Areas (b) (7)(E) Alternative 4

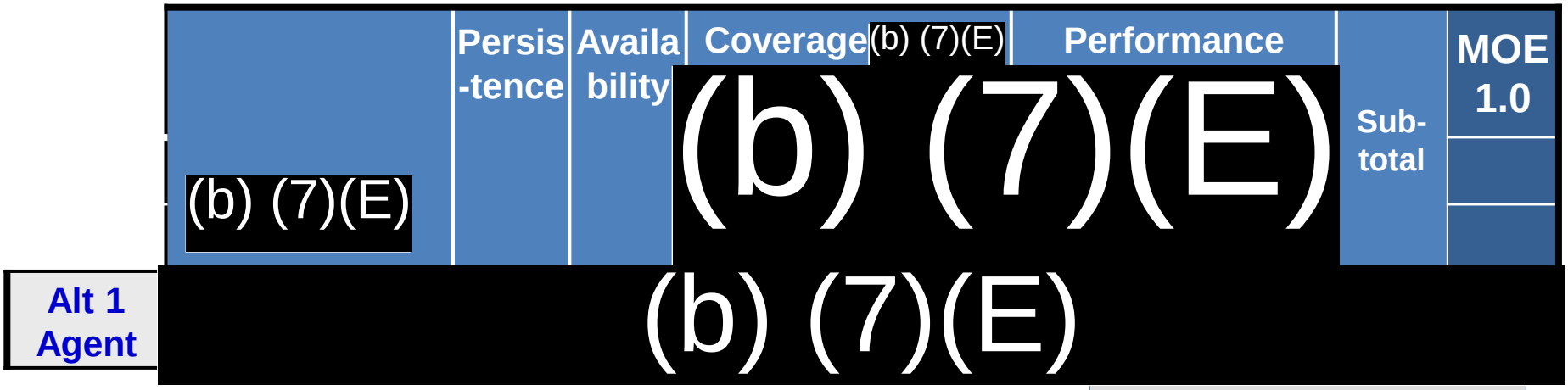
Area of Detailed Analysis	Alt 4 (Aviation-UAS)
(b) (7)(E)	(b) (7)(E)

(b) (7)(E)

*Assuming that the UASs are deployed over all stations in the corresponding sector.

(b) (7)(E)

Evaluation: MOE1.0 - Example



= *"Low" or "High" values (see slide title)*

Sample computation for Alt 1:

(b) (7)(E)

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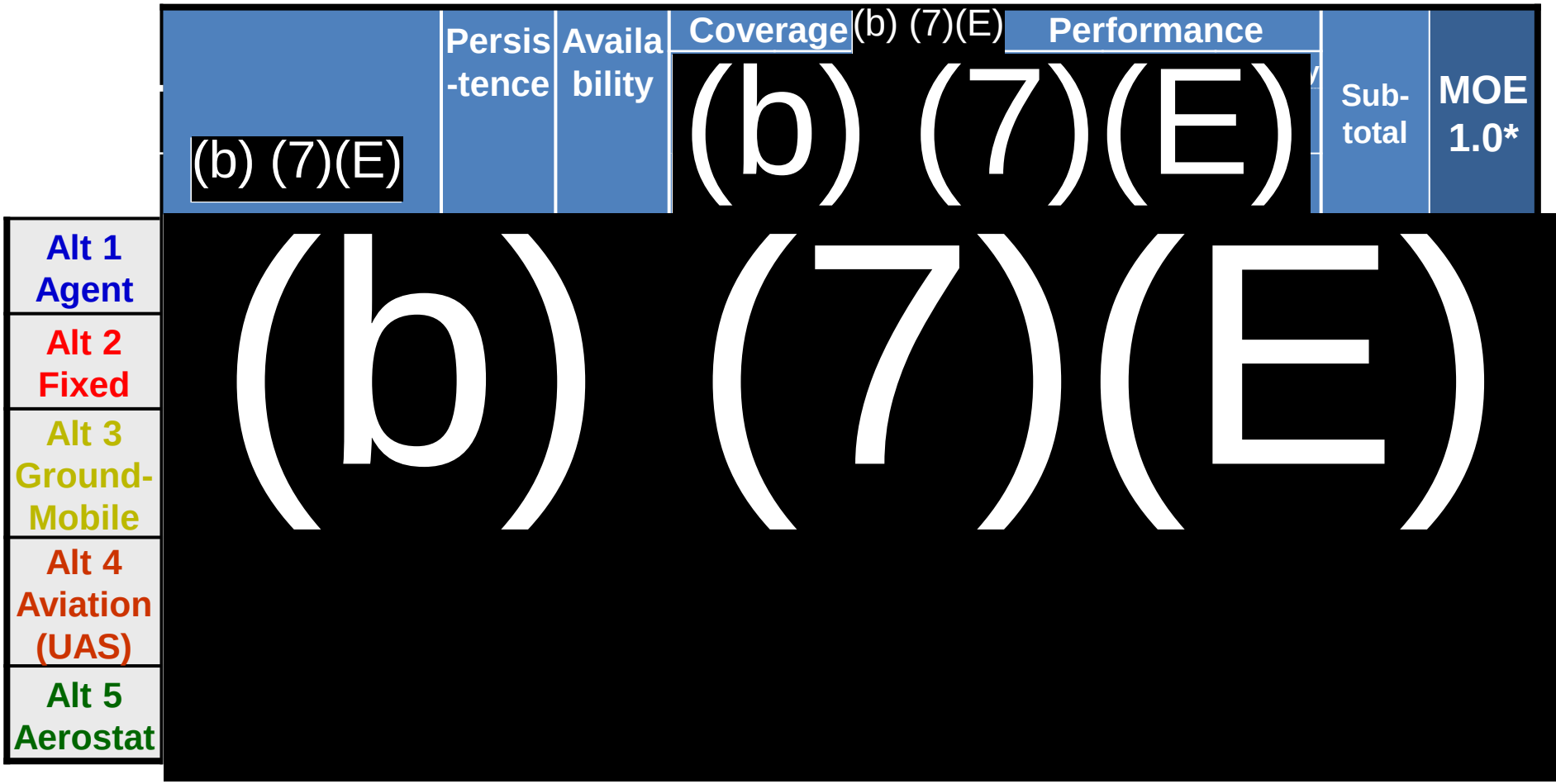
Evaluation: MOE1.0 (low)

(b) (7)(E)



(b) (7)(E)

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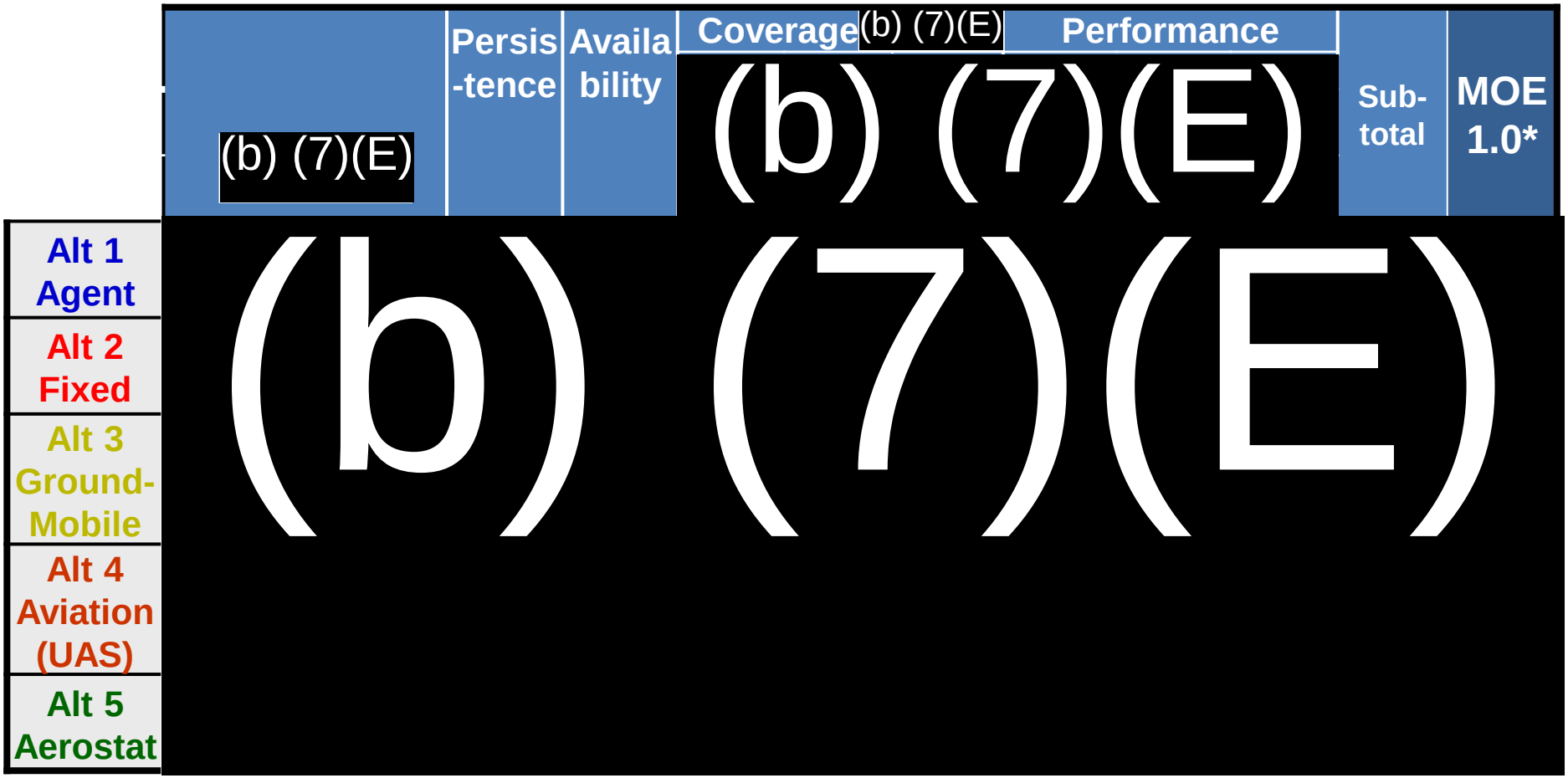
Evaluation: MOE1.0 (high)

(b) (7)(E)



(b) (7)(E)

BW FOIA CBP 003376

Evaluation: MOE 1.0

Results for All Analysis Areas (b) (7)(E)

(b) (7)(E)

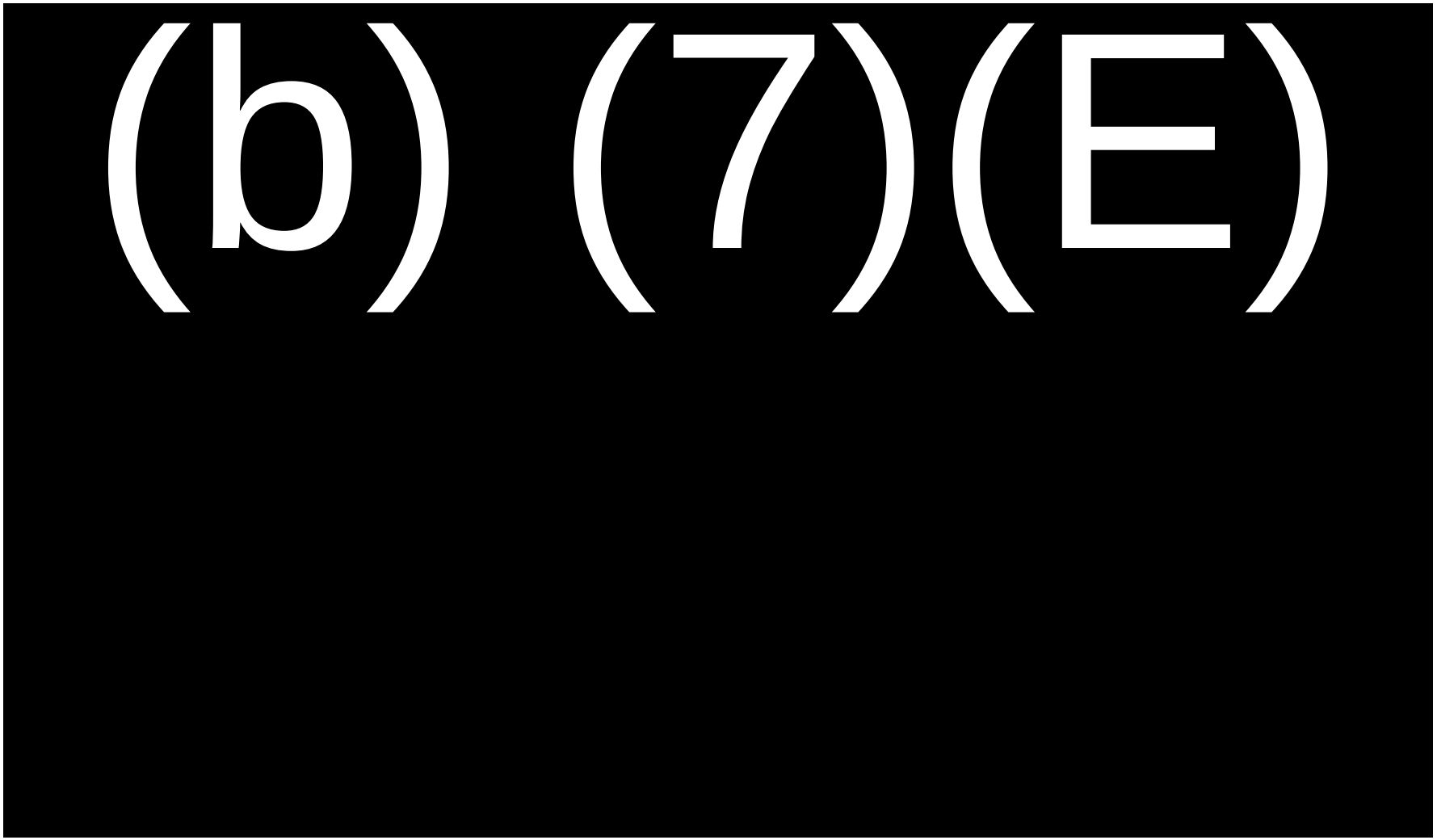
— : Baseline
Alt 1: Agent-Centric
Alt 2: Fixed (Tower)
Alt 3: Ground-Mobile
Alt 4: Aviation (UAS)
Alt 5: Aerostat

*For this MOE, Alts 3a and 3b are equivalent

(b) (7)(E)

MOE 1.0: Provide Monitoring and Persistent Surveillance

MOE1.0: Limiting/Enabling Factors



MOE 2.0

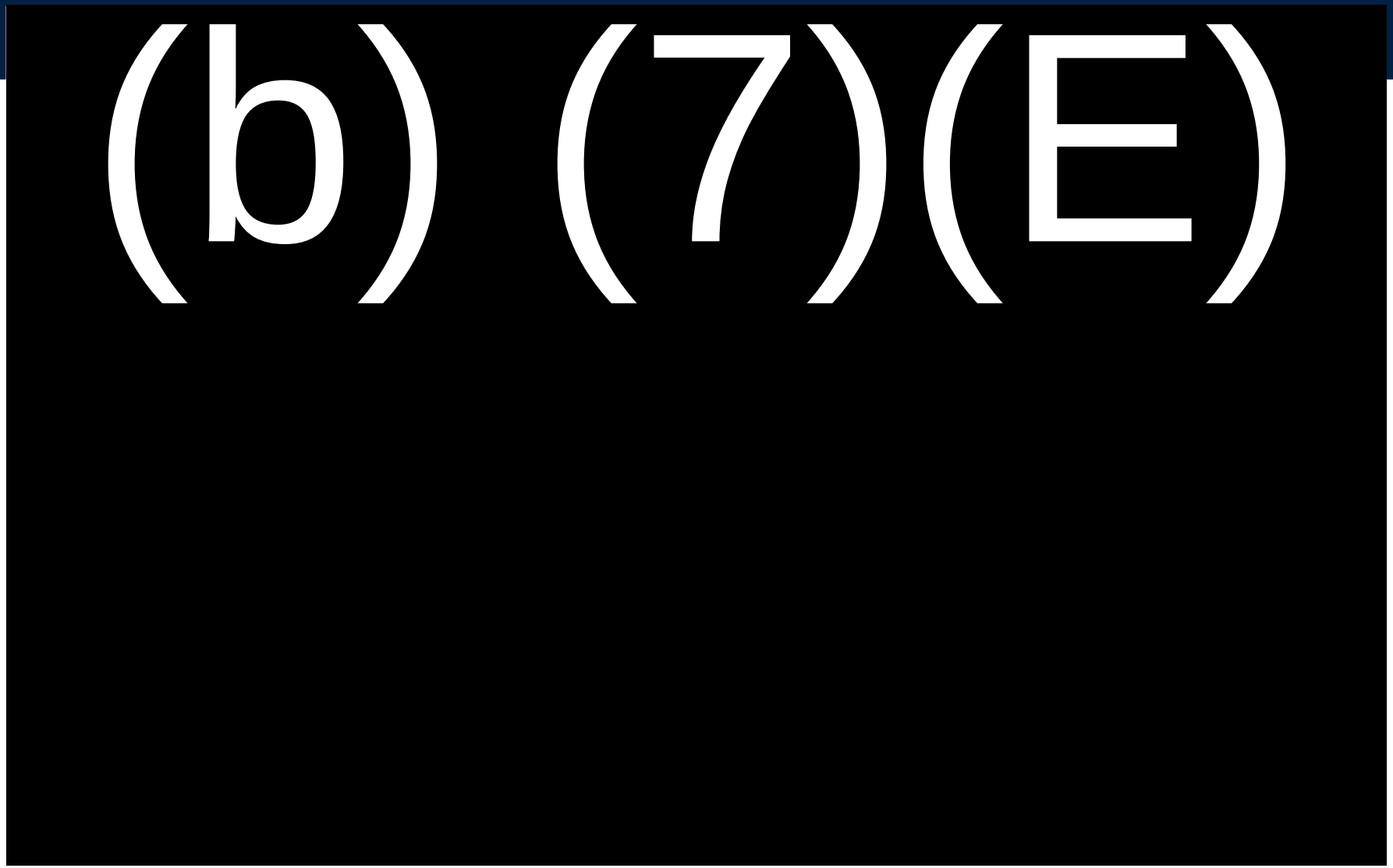
Enable Timely and Effective Response

(b) (7)(E)

MOE 2.0: (b) (7)(E)

(b) (7)(E)

MOE 2.0: Maximum Response Area



MOE 2.0: (b) (7)(E)

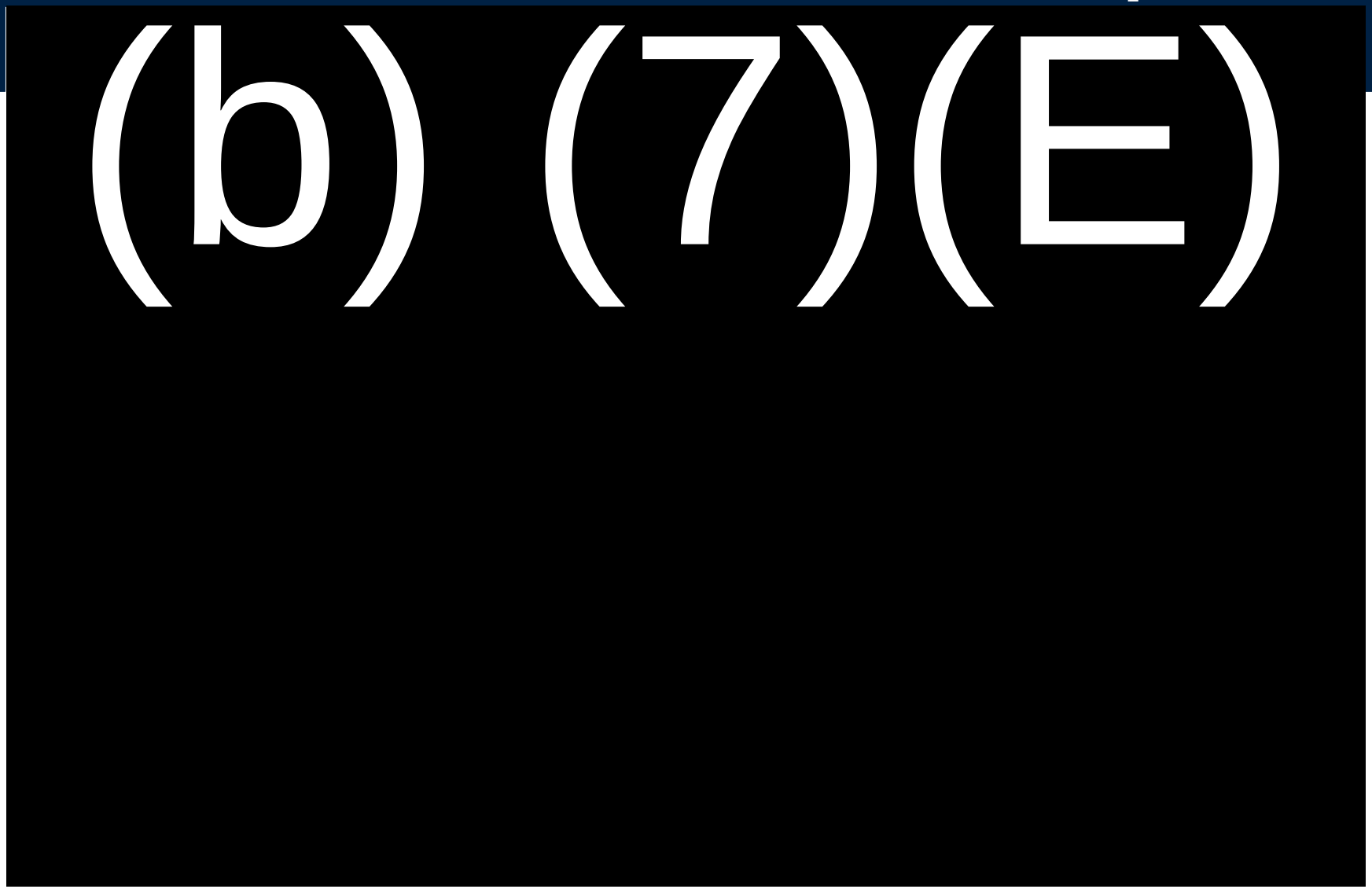
(b) (7)(E)

MOE 2.0: (b) (7)(E)

(b) (7)(E)

BW FOIA CBP 003383

Evaluation: MOE 2.0 - Example



Evaluation: MOE 2.0

Results for All Analysis Areas (b) (7)(E)

(b) (7)(E)

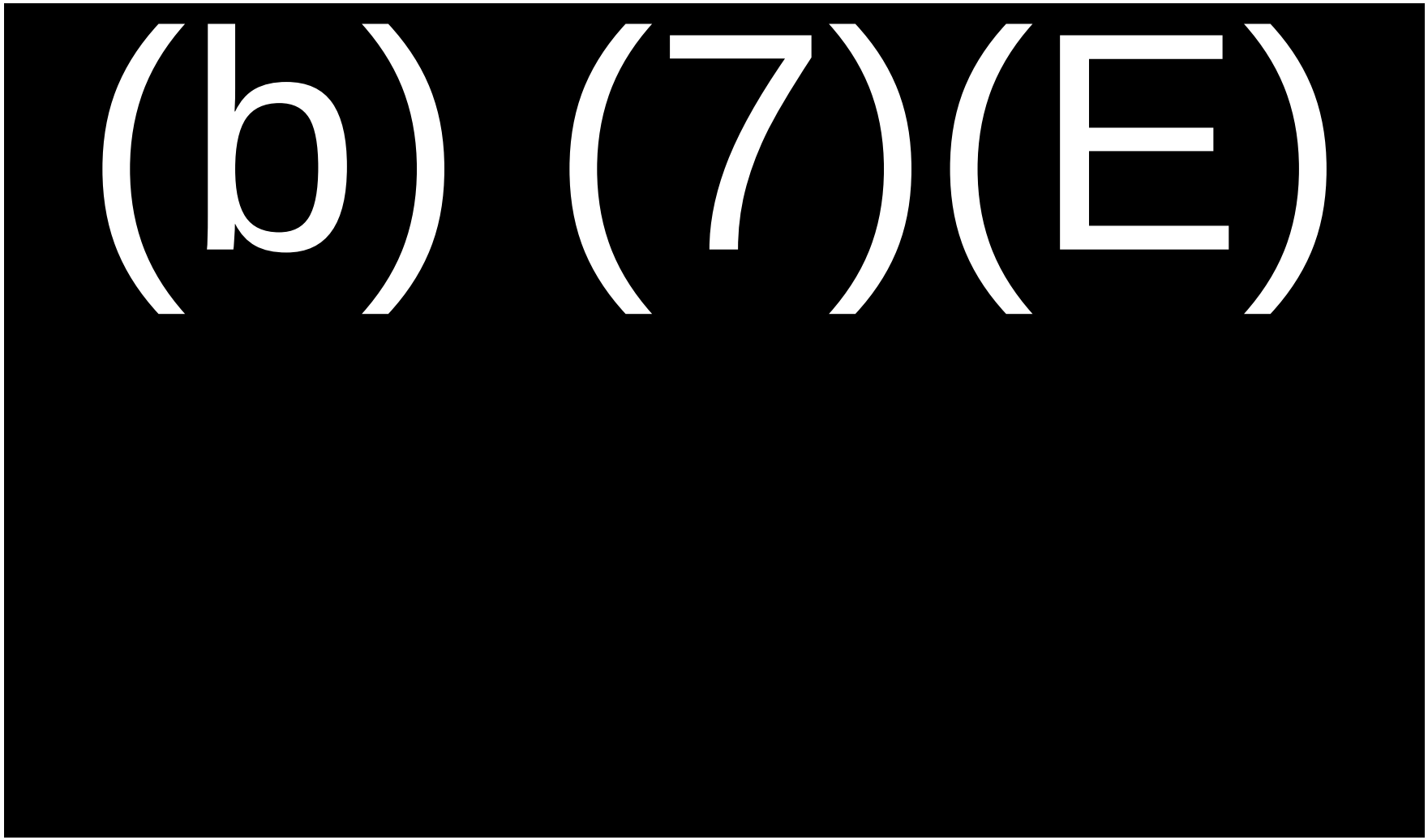
— : Baseline
Alt 1: Agent-Centric
Alt 2: Fixed (Tower)
Alt 3: Ground-Mobile
- 3a: Stand-alone
- 3b: Network (adjacent)

Alt 4: Aviation (UAS)
Alt 5: Aerostat

(b) (7)(E)

MOE 2.0: Enable Timely and Effective Response

MOE 2.0: Limiting/Enabling Factors



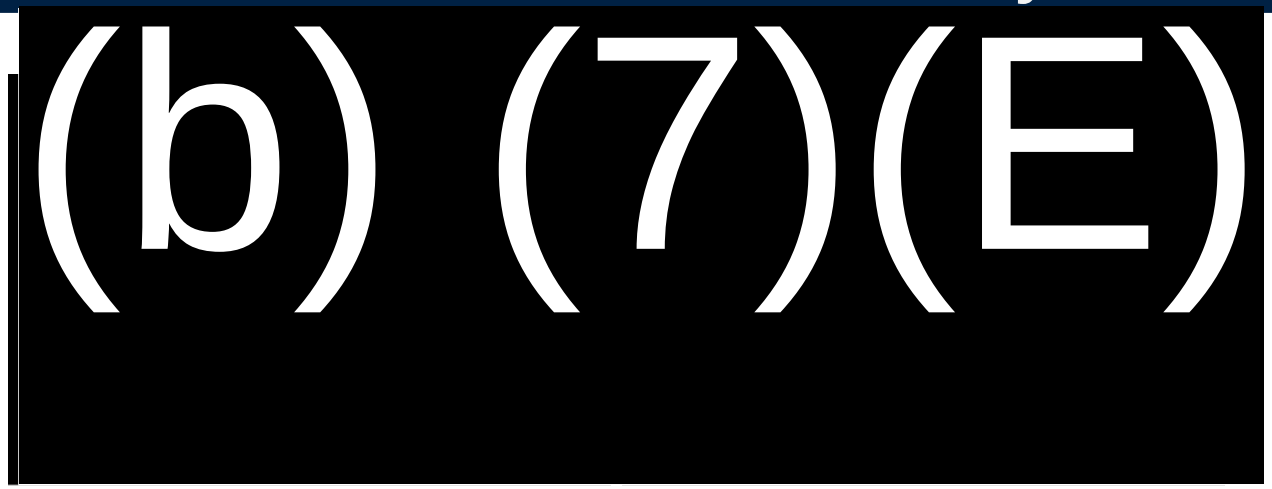
MOE 3.0

Support Other OBP Mission Elements

(b) (7)(E)

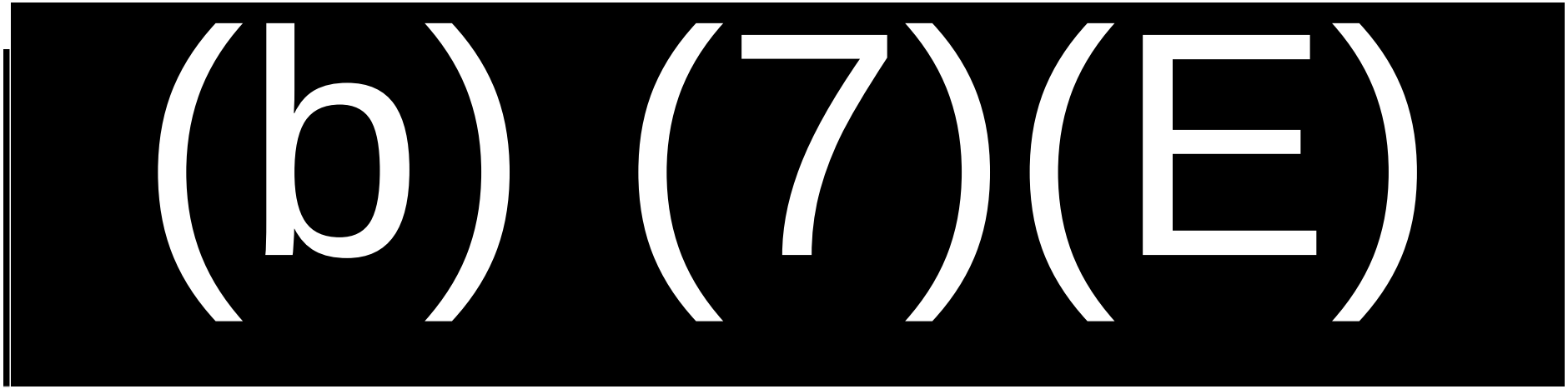
Evaluation: MOE 3.0

Results for All Analysis Areas (b) (7)(E)



— : Baseline
Alt 1: Agent-Centric
Alt 2: Fixed (Tower)
Alt 3: Ground-Mobile
Alt 4: Aviation (UAS)
Alt 5: Aerostat

*For this MOE, scores for Alts 3a and 3b do not differ significantly



MOE 3.0: Support Other OBP Mission Elements

MOE 4.0

- **Approach**

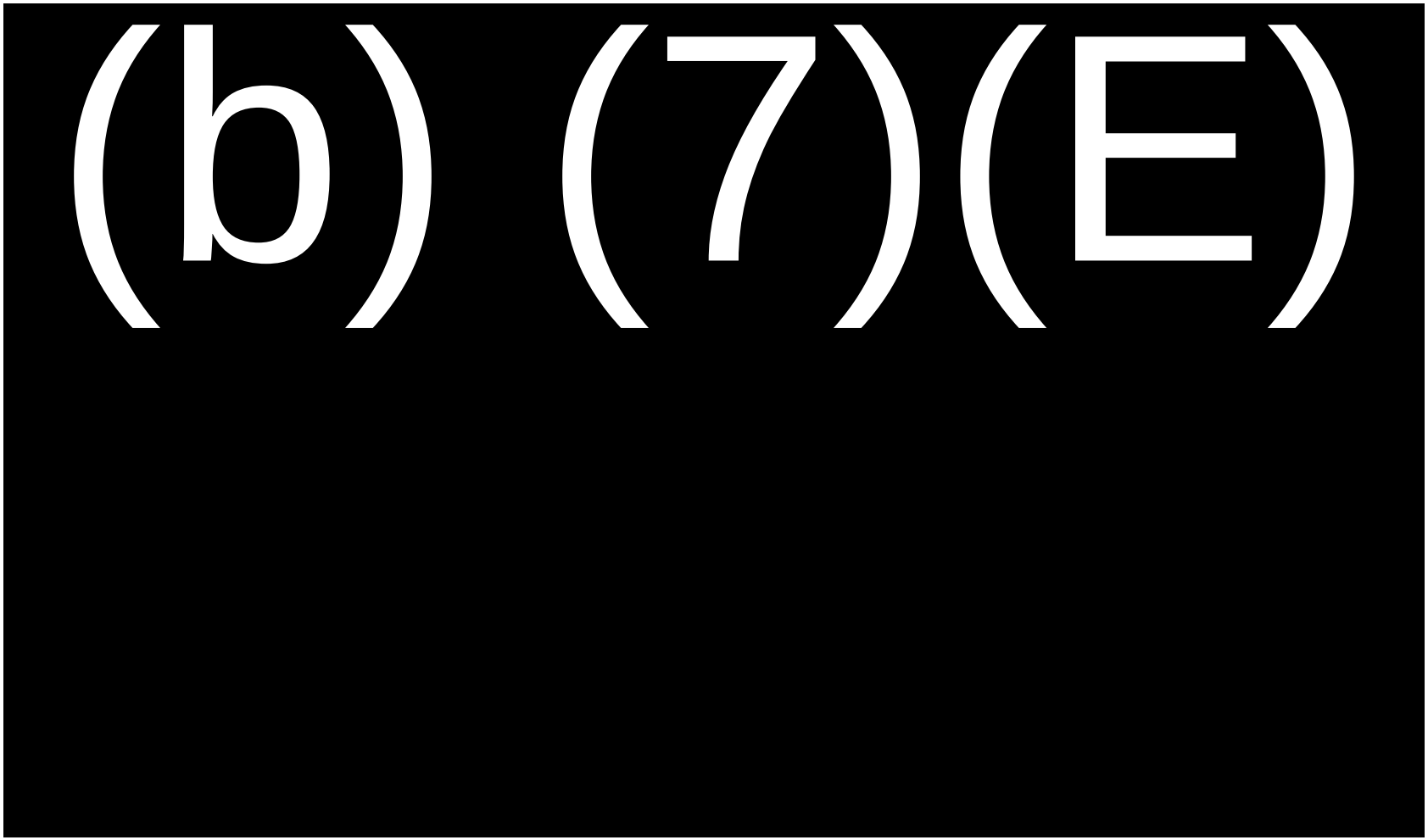
(b) (7)(E)

- **Measurement**

(b) (7)(E)

MOE 4.0

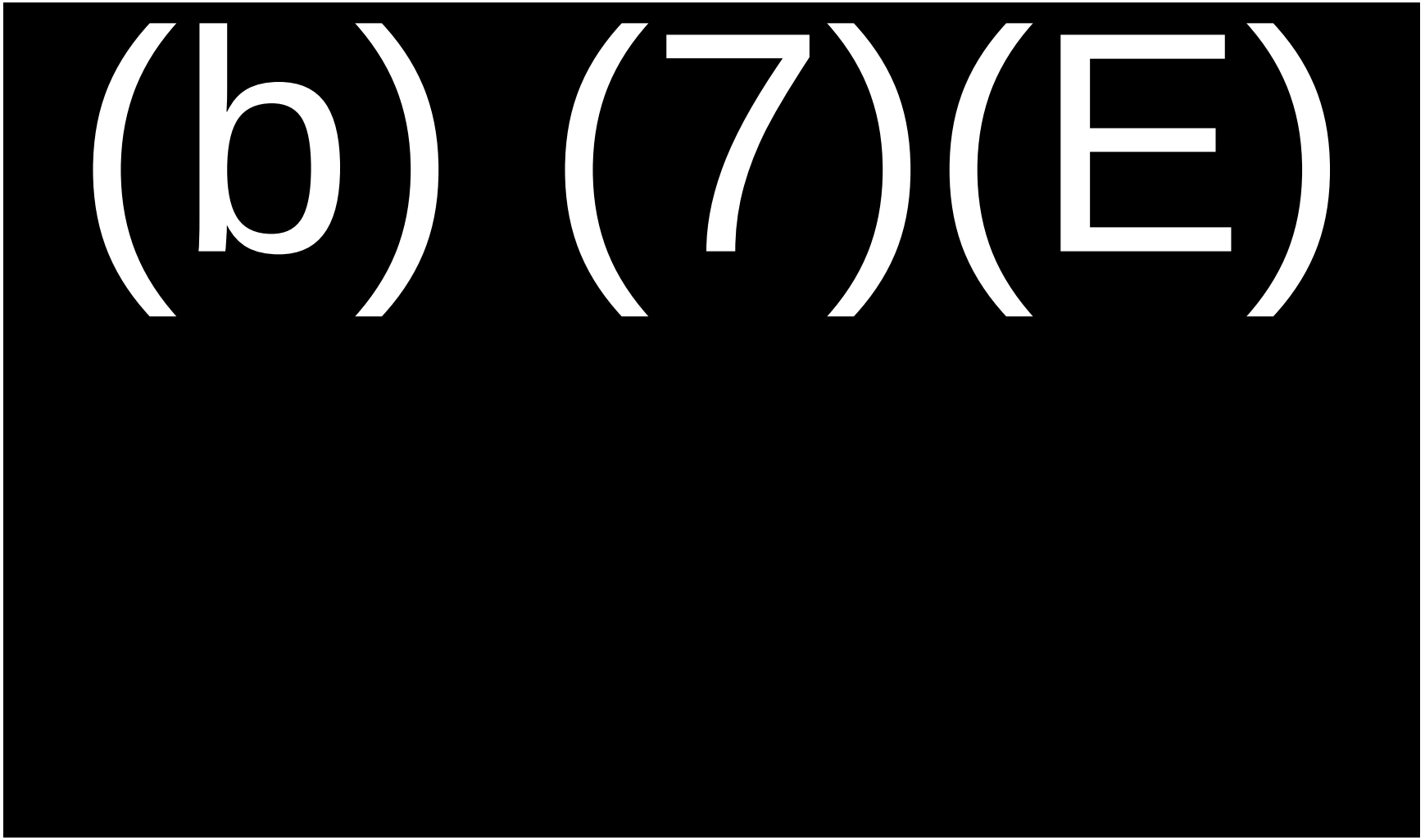
Ground Rules and Assumptions



BW FOIA CBP 003390

MOE 4.0

Ground Rules and Assumptions (cont)



BW FOIA CBP 003391

MOE 4.0

Inputs

Item	Approx Unit Cost ($K, Then-Year)	Comments
(b) (7)(E)		

BW FOIA CBP 003392

MOE 4.0

(b) (7)(E)

Redeployment Cost ($K)		(b) (7)(E)	Notes
Alt 1	Agent-Centric		(b) (7)(E)
Alt 2	Fixed		
Alt 3	Ground-Mobile		
Alt 4	Aviation (UAS)		
Alt 5	Aerostat		

First purchase Cost ($K)		(b) (7)(E)	Notes
Alt 1	Agent-Centric		Excludes technology refresh and UAS satellite lease costs.
Alt 2	Fixed		
Alt 3	Ground-Mobile		
Alt 4	Aviation (UAS)		
Alt 5	Aerostat		

BW FOIA CBP 003393

MOE 4.0

Results

(b) (7)(E)

—— : Baseline
Alt 1: Agent-Centric
Alt 2: Fixed (Tower)
Alt 3: Ground-Mobile
Alt 4: Aviation (UAS)
Alt 5: Aerostat

*For this MOE, scores for Alts 3a and 3b do not differ significantly

(b) (7)(E)

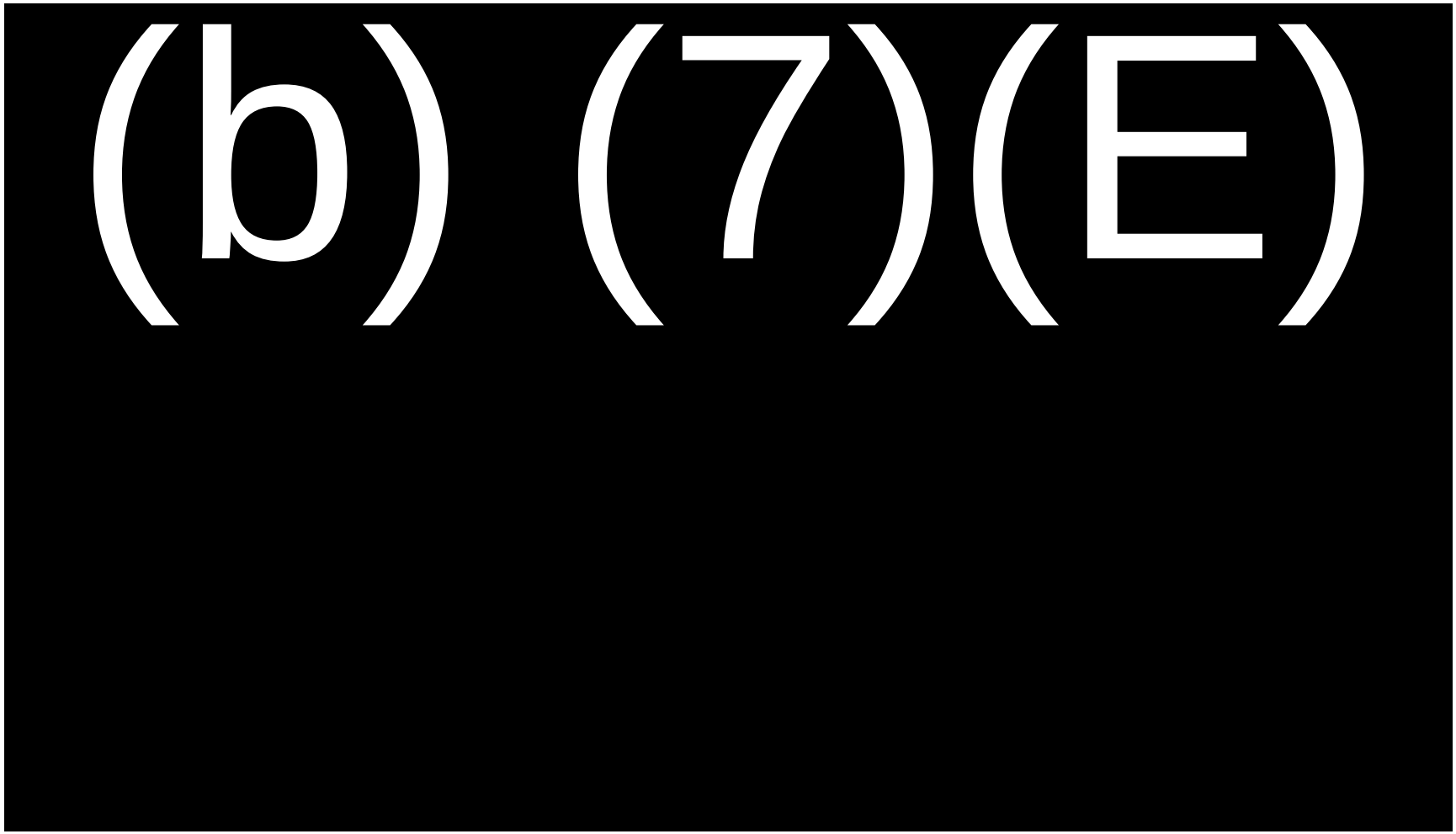
MOE 4.0: Provide an Agile and Supportable Capability

(b) (7)(E)

CBP 003394

MOE 5.0

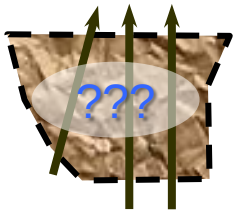
Provide Strategic Intelligence

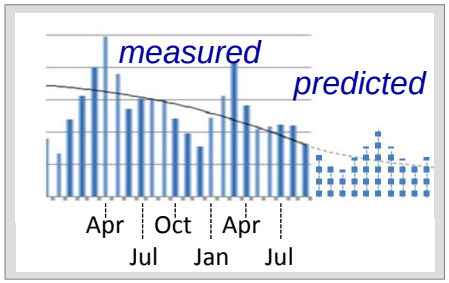


MOE 5.0

Approach

(b) (7)(E)



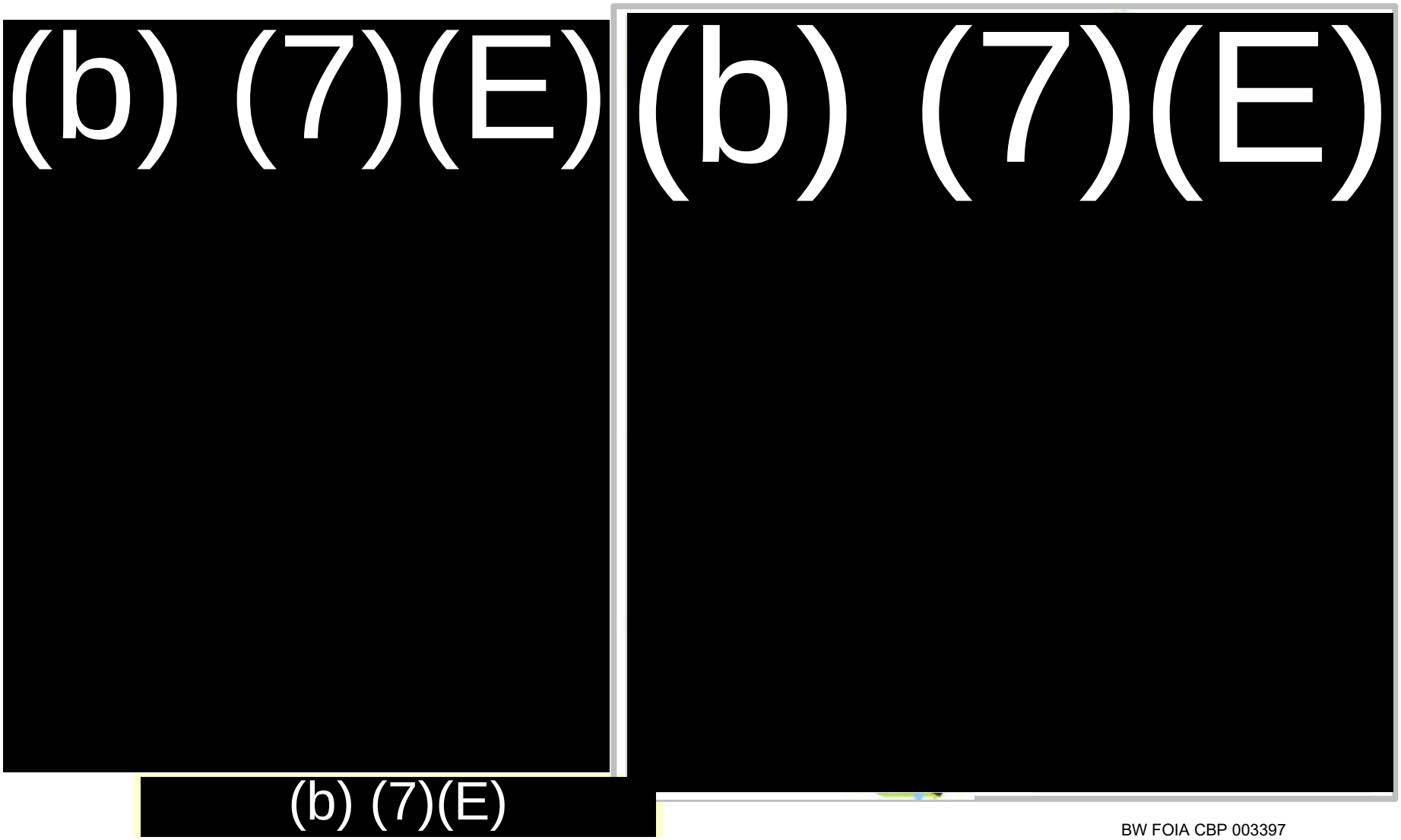


(b) (7)(E)

BW FOIA CBP 003396

MOE 5.0: Spatial Coverage

(b) (7)(E)



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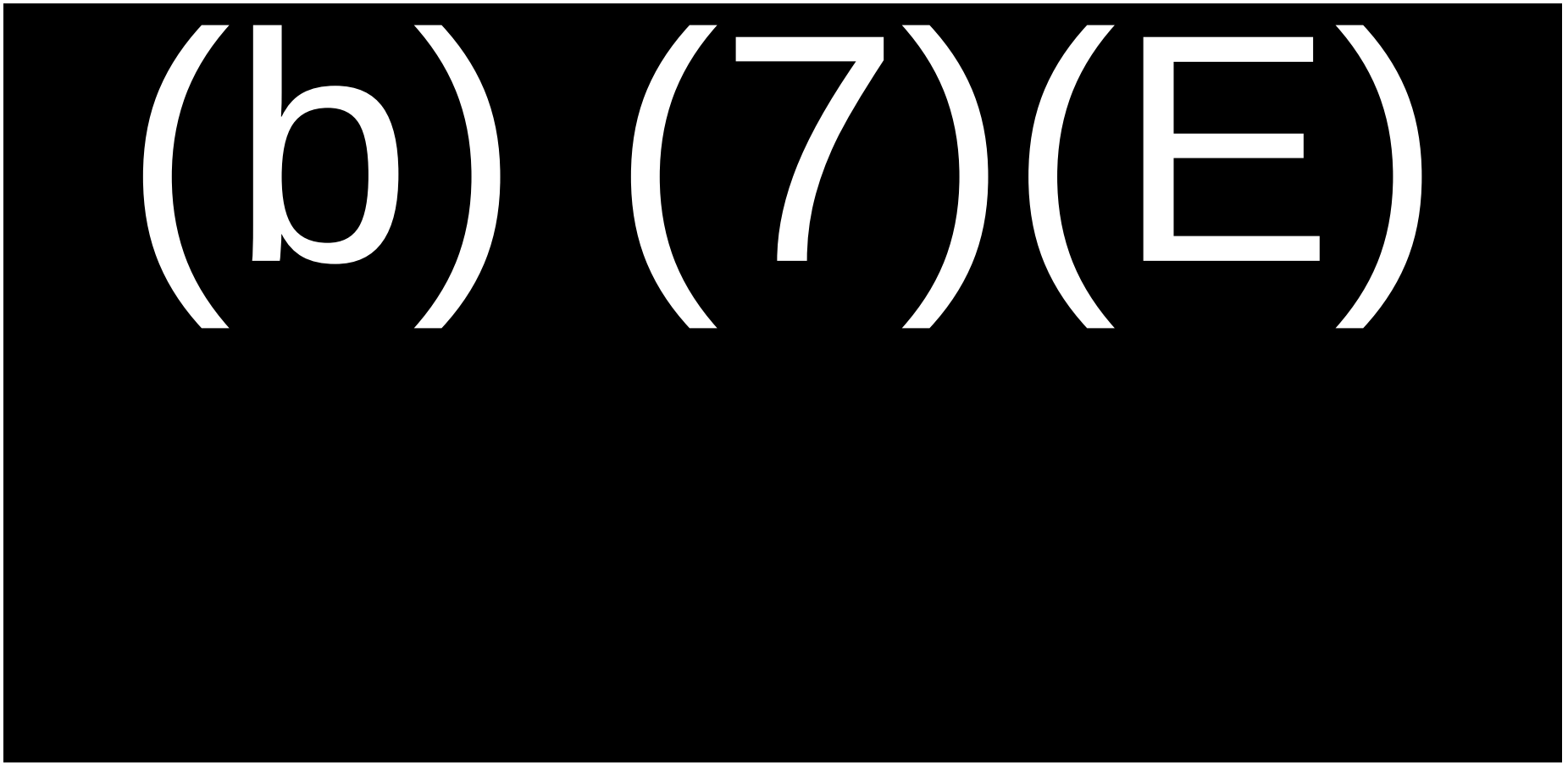
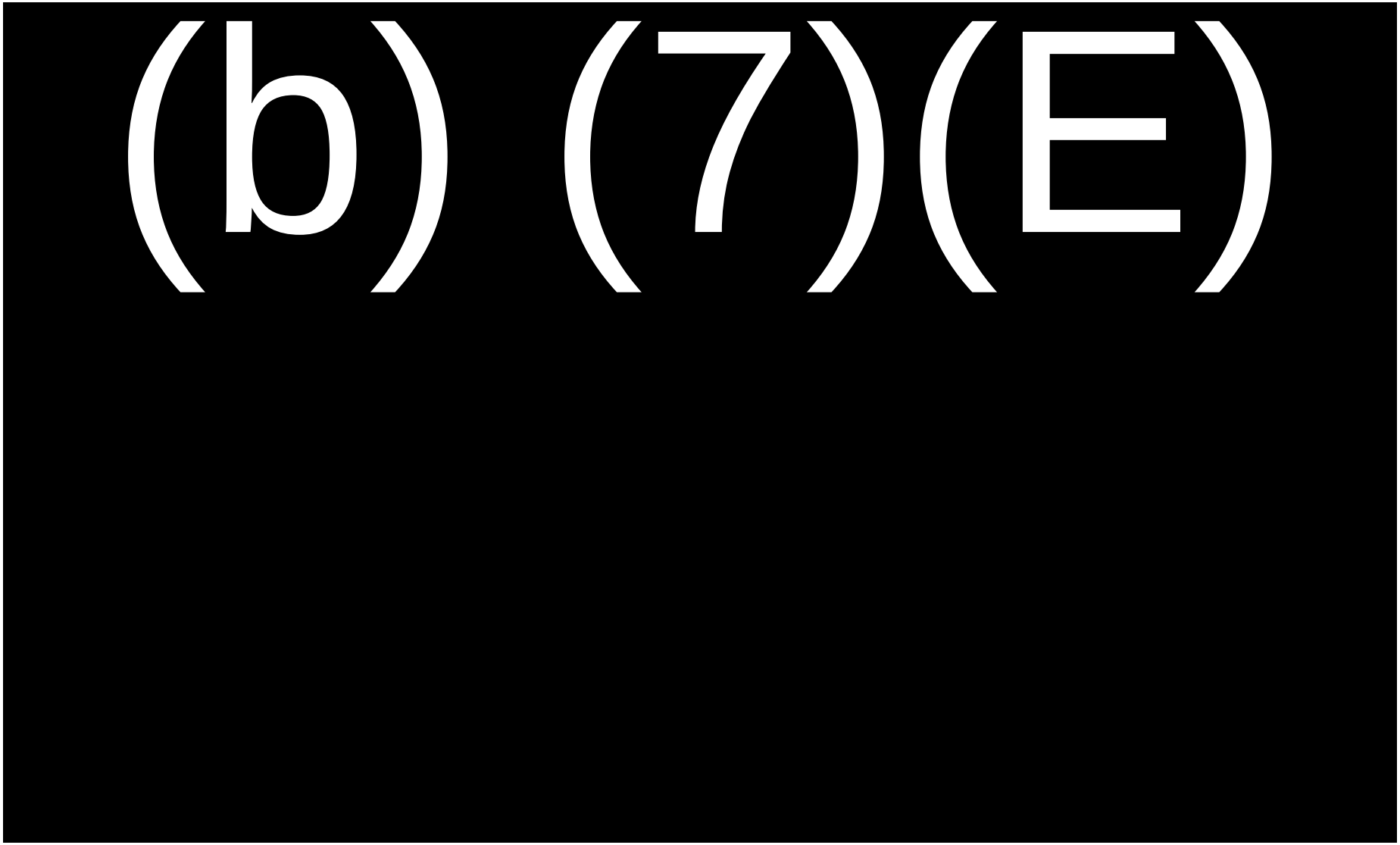
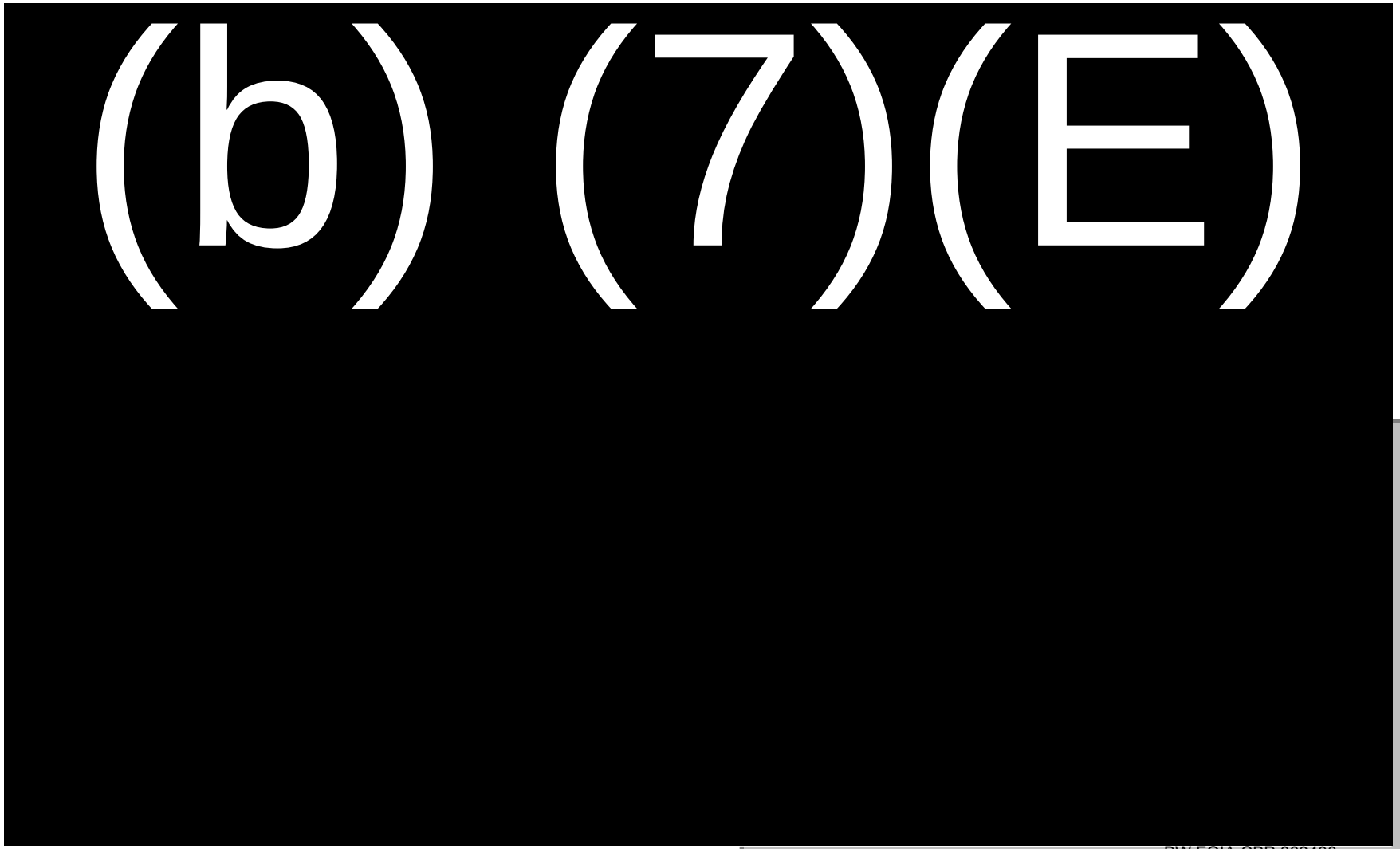
MOE 5.0: Frequency



MOE 5.0: Frequency & Spatial Coverage



MOE 5: Mobility, External Information

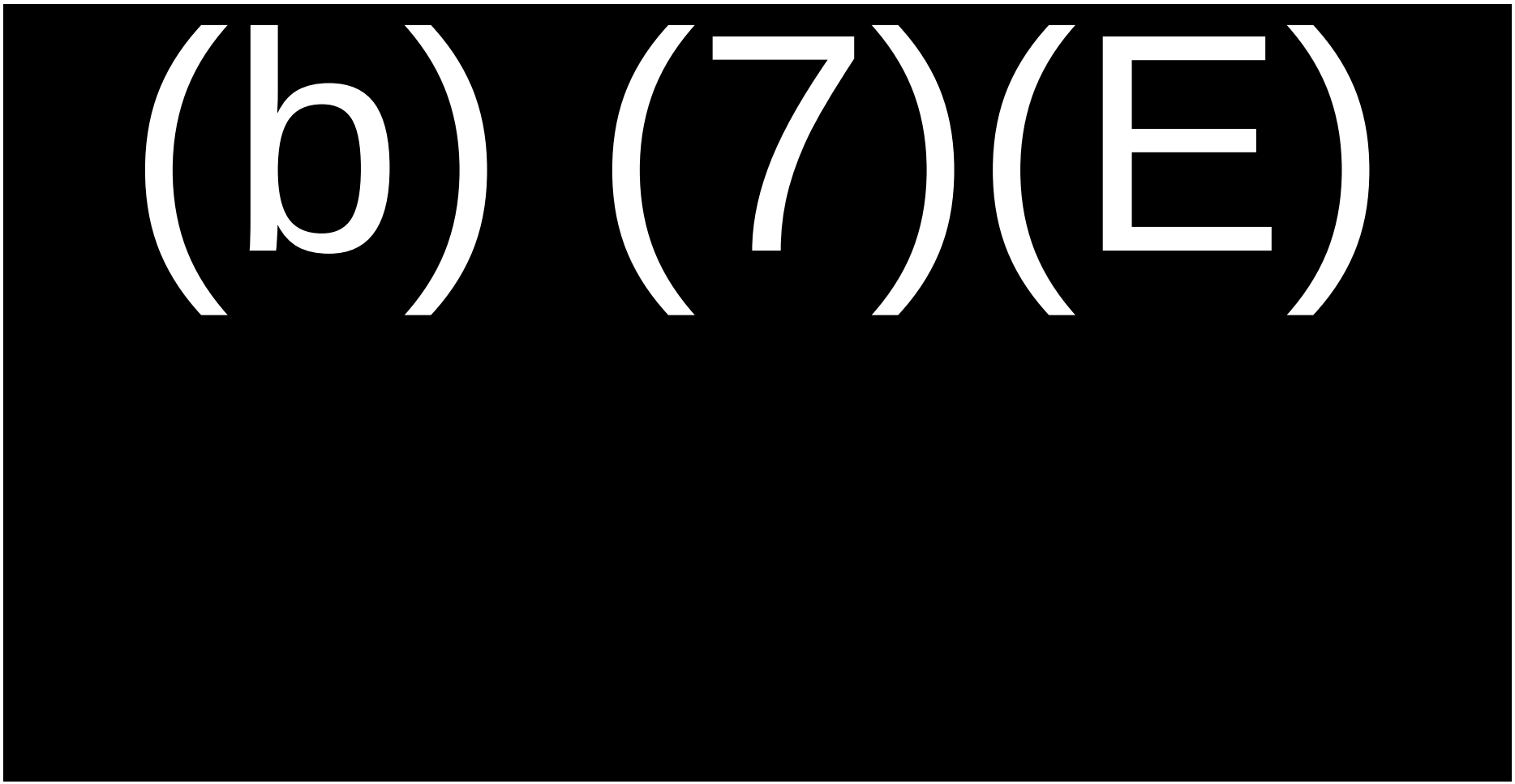


Evaluation: MOE 5.0 - Example

(b) (7)(E)

Evaluation: MOE 5.0 (low)

(b) (7)(E)



Evaluation: MOE 5.0

Results for All Analysis Areas (b) (7)(E)

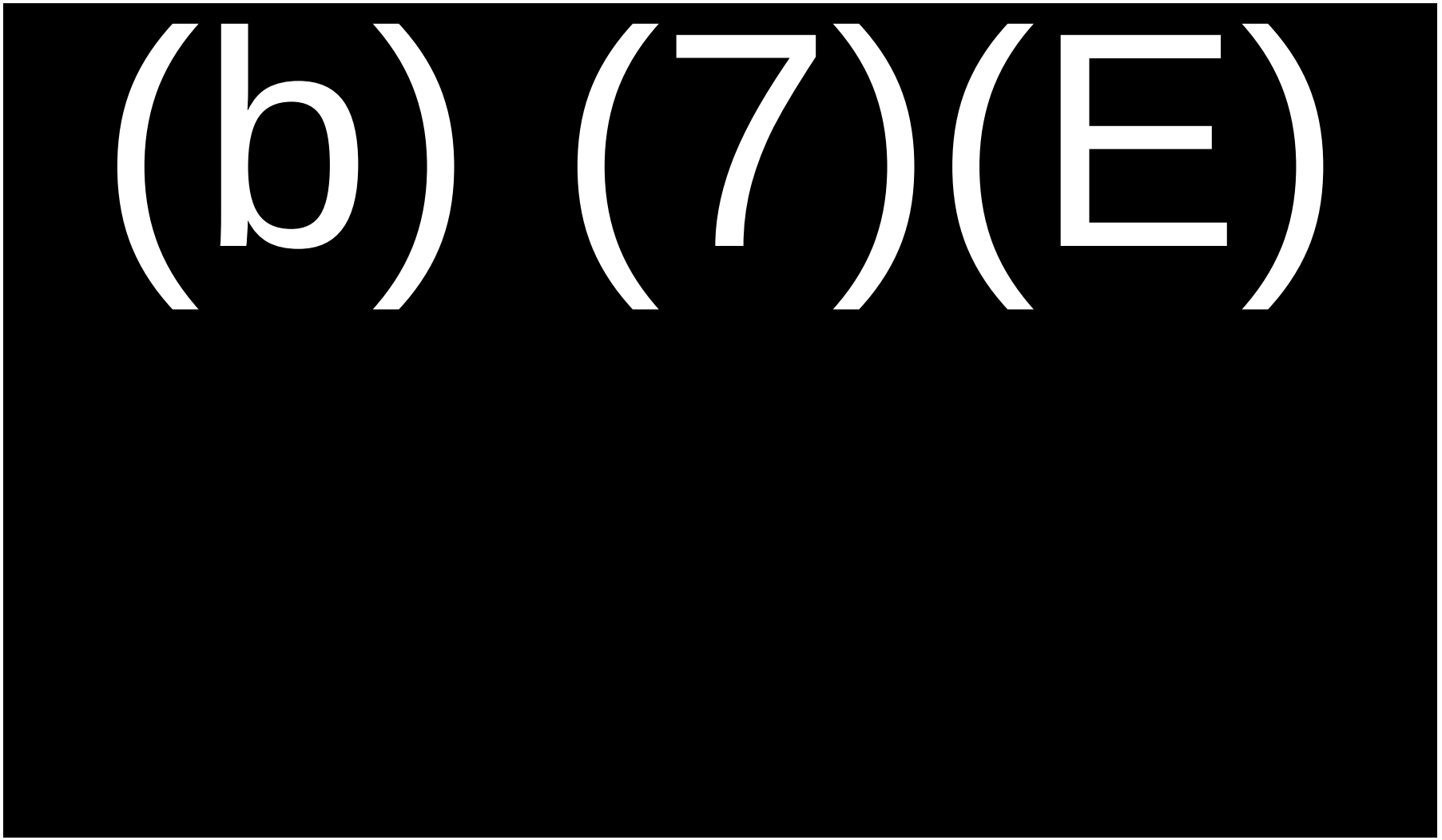
(b) (7)(E)

BW FOIA CBP 003403

MOE 5.0: Limiting / Enabling Factors

(b) (7)(E)

MOE 6.0
Provide Dynamic Surveillance



MOE 6.0: Paths

(b) (7)(E)

(b) (7)(E)

MOE 6.0: (b) (7)(E)

(b) (7)(E)

(b) (7)(E)

(b) (7)(E)

BW FOIA CBP 003407

MOE 6.0: (b) (7)(E)

(b) (7)(E)

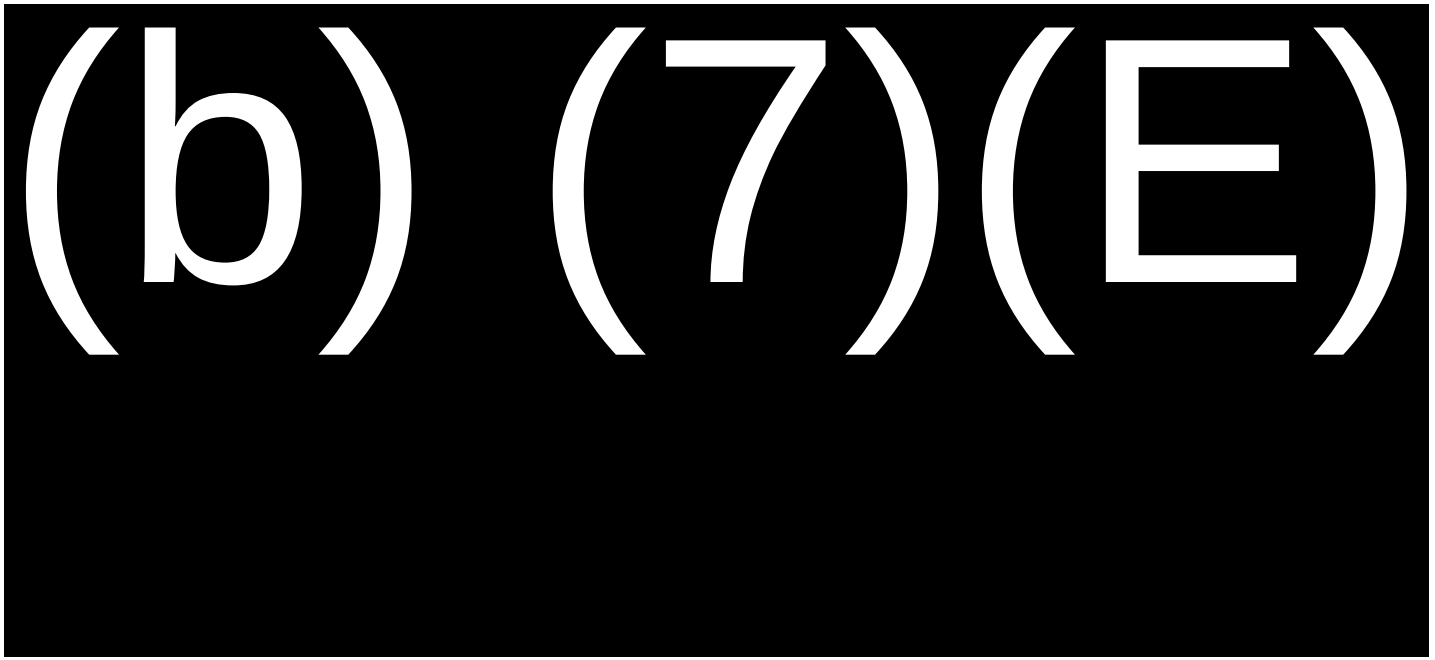
(b) (7)(E)

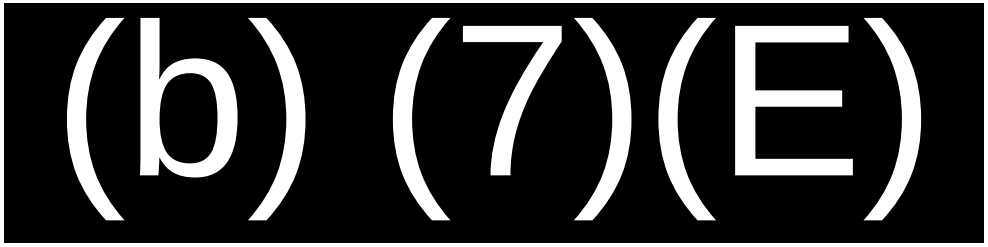
(b) (7)(E)

BW FOIA CBP 003408

MOE 6.0: Alt 6 (b) (7)(E)

(b) (7)(E)

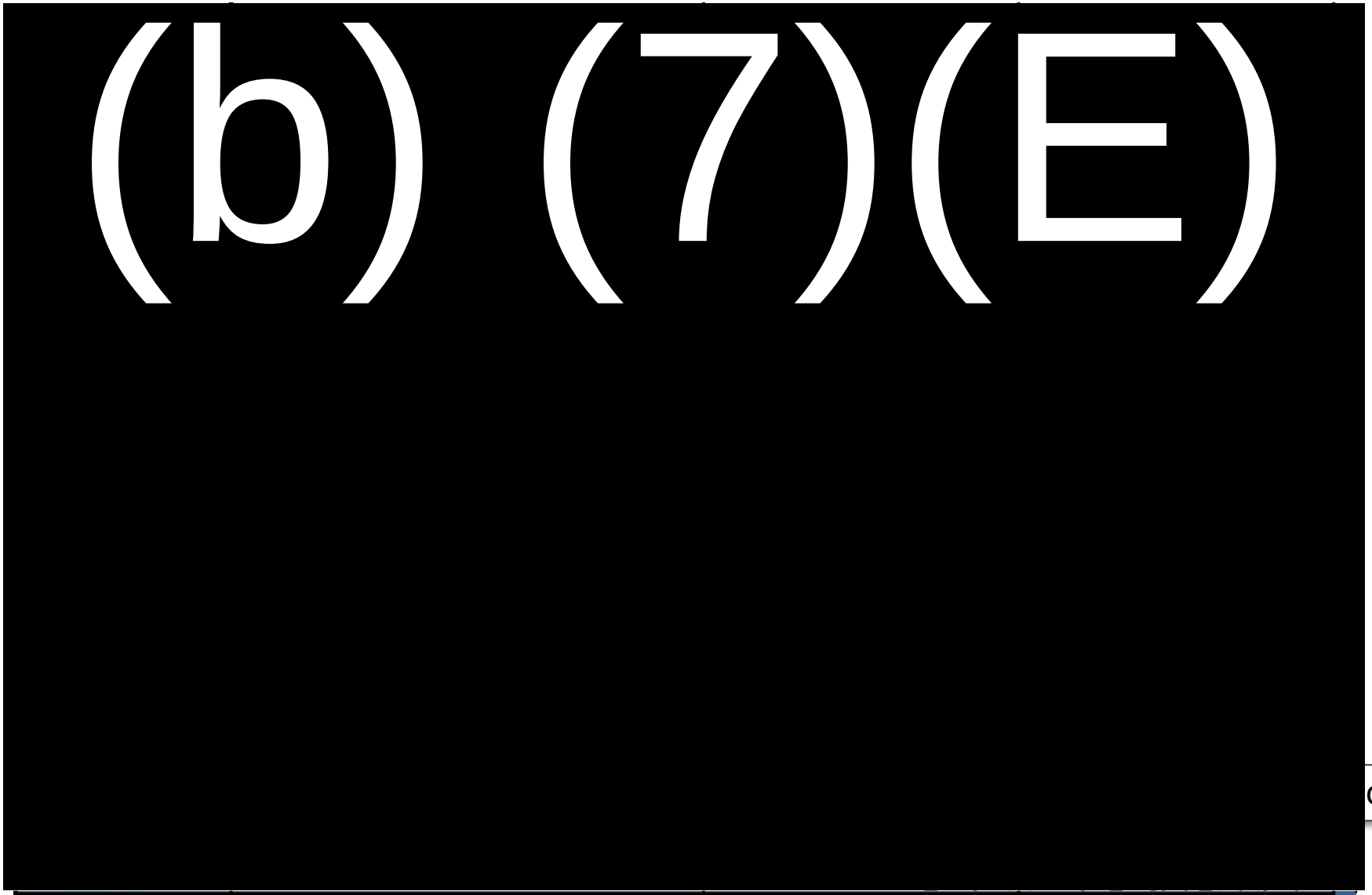




BW FOIA CBP 003409

Evaluation: MOE 6.0 - Example

(b) (7)(E)



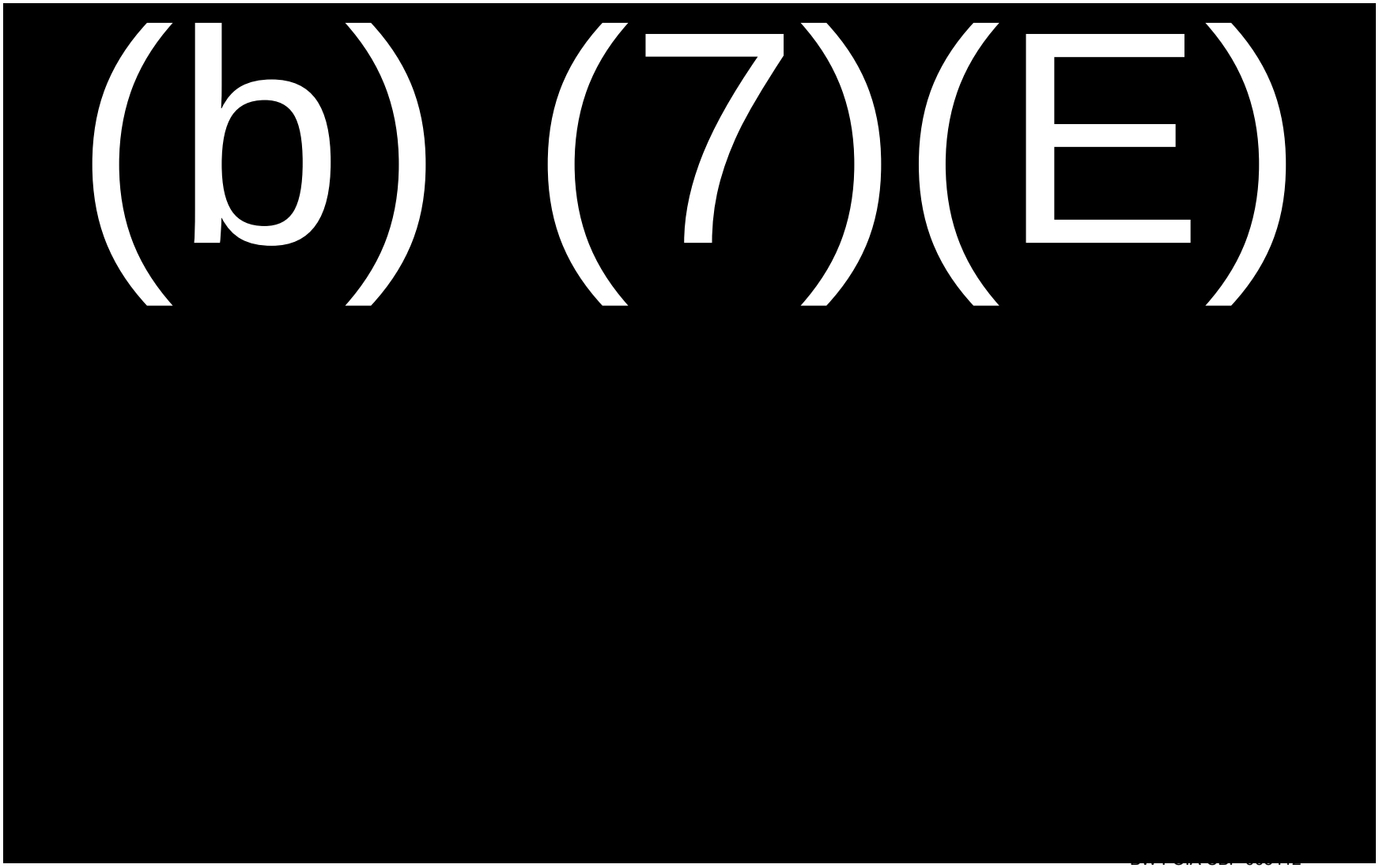
c. …

Evaluation: MOE 6.0

Results for All Analysis Areas E-J

(b) (7)(E)

MOE 6.0: Limiting / Enabling Factors



Outline

- **Introduction**
- **Alternatives**
- **Effectiveness Analysis**
  - Measures of Effectiveness
  - Inputs
  - Sources of Uncertainty
  - Detailed Analysis Results
    - MOE 3.0
    - MOE 4.0
    - MOE 1.0
    - MOE 2.0
    - MOE 5.0
    - MOE 6.0
  - Summary & Observations
- **Cost Analysis**
- **Summary**
- **Additional Topics**

(b) (7)(E)

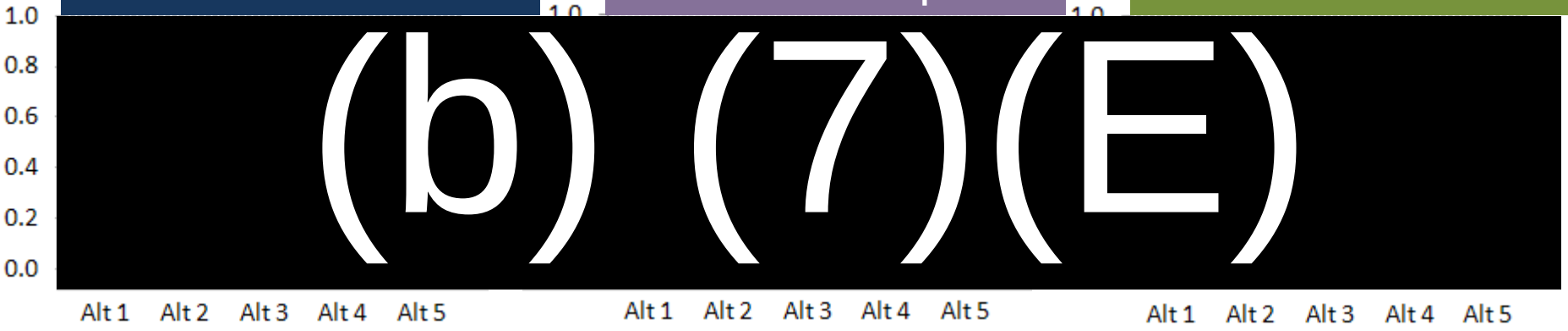
Operational Effectiveness

(b) (7)(E)

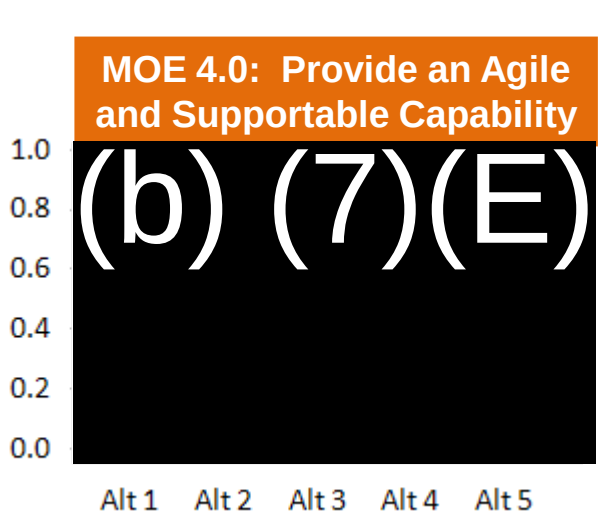
MOE 1.0: Provide Monitoring and Persistent Surveillance

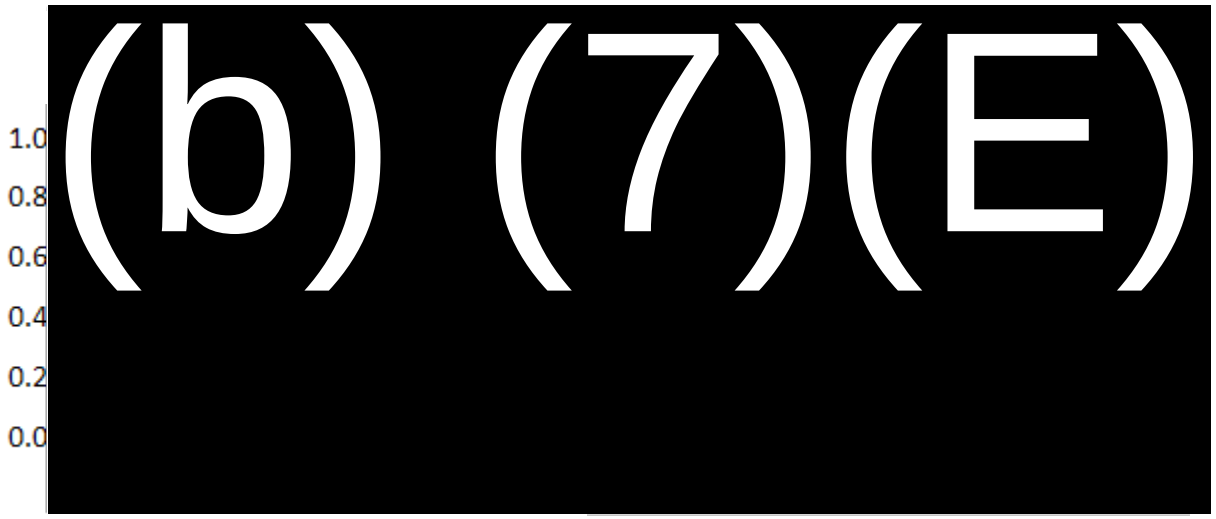
MOE 2.0: Enable Timely and Effective Response

MOE 3.0: Support Other OBP Mission Elements



MOE 4.0: Provide an Agile and Supportable Capability





(b) (7)(E)

CBP 003414

(b) (7)(E)

Operational Effectiveness

(b) (7)(E)

MOE 1.0: Provide Monitoring and Persistent Surveillance

MOE 2.0: Enable Timely and Effective Response

MOE 3.0: Support Other OBP Mission Elements

(b) (7)(E)

Alt 1 Alt 2 Alt 3 Alt 4 Alt 5

Alt 1 Alt 2 Alt 3 Alt 4 Alt 5

MOE 4.0: Provide an Agile and Supportable Capability

(b) (7)(E)

Alt 1 Alt 2 Alt 3 Alt 4 Alt 5

(b) (7)(E)

: Baseline

Alt 1: Agent-Centric

Alt 2: Fixed (Tower)

Alt 3: Ground-Mobile

Alt 4: Aviation (UAS)

Alt 5: Aerostat

(b) (7)(E)

Operational Effectiveness

(b) (7)(E)

MOE 1.0: Provide Monitoring

MOE 2.0: Enable Timely

MOE 3.0: Support Other

(b) (7)(E)

Alt 1 Alt 2 Alt 3 Alt 4 Alt 5

MOE 4.0: Provide an Agile and Supportable Capability

(b) (7)(E)

(b) (7)(E)

: Baseline

Alt 1: Agent-Centric

Alt 2: Fixed (Tower)

Alt 3: Ground-Mobile

Alt 4: Aviation (UAS)

Alt 5: Aerostat

(b) (7)(E)

Operational Effectiveness

(b) (7)(E)

MOE 1.0: Provide Monitoring and Persistent Surveillance

MOE 2.0: Enable Timely and Effective Response

MOE 3.0: Support Other OBP Mission Elements

(b) (7)(E)

Alt 1 Alt 2 Alt 3 Alt 4 Alt 5

MOE 4.0: Provide an Agile and Supportable Capability

(b) (7)(E)

(b) (7)(E)

: Baseline
Alt 1: Agent-Centric
Alt 2: Fixed (Tower)
Alt 3: Ground-Mobile
Alt 4: Aviation (UAS)
Alt 5: Aerostat

(b) (7)(E)

Operational Effectiveness

(b) (7)(E)

MOE 1.0: Provide Monitoring and Persistent Surveillance

MOE 2.0: Enable Timely and Effective Response

MOE 3.0: Support Other OBP Mission Elements

(b) (7)(E)

MOE 4.0: Provide an Agile and Supportable Capability

(b) (7)(E)

(b) (7)(E)

: Baseline

Alt 1: Agent-Centric

Alt 2: Fixed (Tower)

Alt 3: Ground-Mobile

Alt 4: Aviation (UAS)

Alt 5: Aerostat

Operational Effectiveness

Summary Observations

- (b) (7)(E)
-
-

Operational Effectiveness

Summary Observations (continued)

- (b) (7)(E)
-

Outline

- **Introduction**
- **Alternatives**
- **Effectiveness Analysis**
- **Cost Analysis**
  - Cost Analysis Approach
  - Rules and Assumptions
  - Uncertainty and Risk
  - Inputs
  - Results
  - Observations
- **Summary**
- **Additional Topics**

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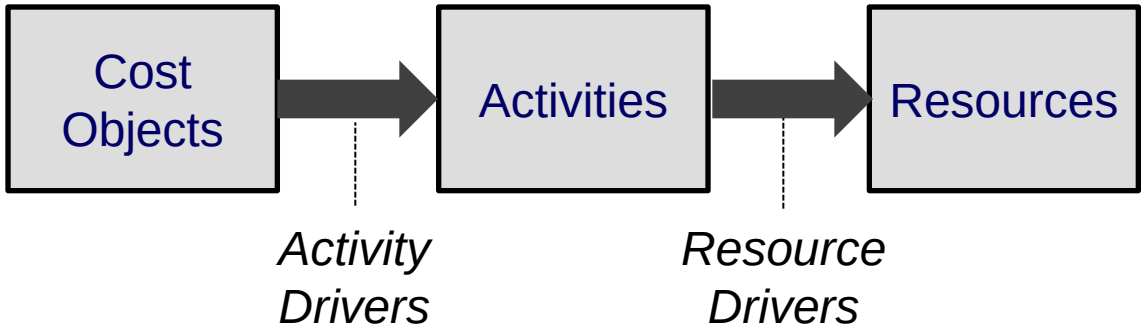
Cost Analysis Approach

- **Parametric cost estimation**
  - Uses mathematical relationships and historical knowledge base
  - Links cost and technical characteristics
- **Price Systems' True Planning® model**
  - Applied over 30+ years; calibrated over thousands of projects
  - Employs an activity-based costing framework



Cost estimating relationships (CERs) capture cost drivers

Ground Rules and Assumptions

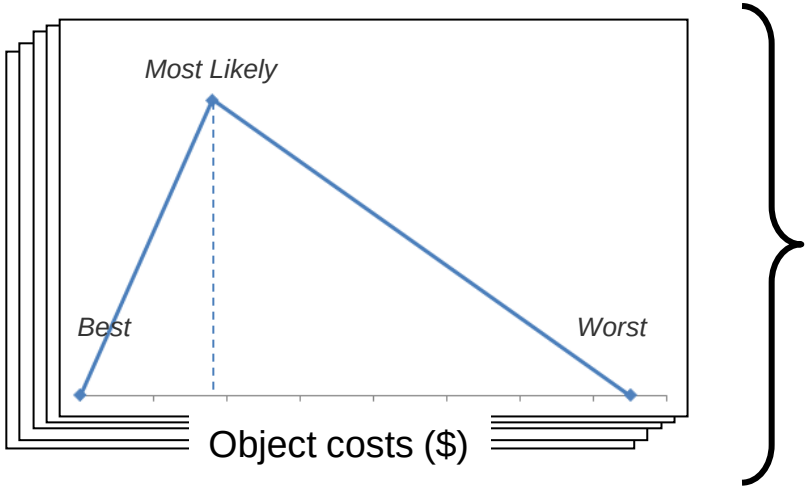
- **Lifecycle period: FY11 – FY20**
  - Estimates provided in Base Year (FY11) and Then Year dollars, with annual escalation at approximately 2.4%
  - [redacted]-year technology refresh (once during lifecycle, unless otherwise noted)
- **Life Cycle Cost Estimate (LCCE) *does not* include:**
  - Program Office costs
  - "Sunk costs" (all costs incurred prior to October 2010)
  - Operations and support cost for all *existing* equipment [redacted]
  - Labor costs for *existing* Border Patrol personnel
    - Note: costs for *additional* personnel* to operate vehicles and sensors *are* included
- **Two-level hardware logistics concept (unless otherwise noted):**
  - Replace at equipment-level, repair at organization-level

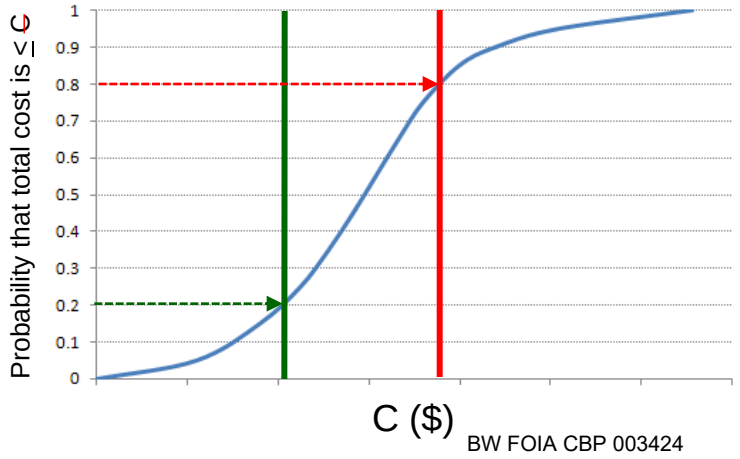
[redacted]

Cost Risk

Risk Analysis Approach

- **Develop best-case, most-likely (point estimate), and worst-case estimates for each cost object**
- **Assume a triangular distribution of possible costs**
- **Perform a Monte-Carlo simulation using the Crystal Ball™ software tool**
- **Provide risk-adjusted estimates at 20th and 80th percentile of cumulative distribution frequency**





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Cost Risk

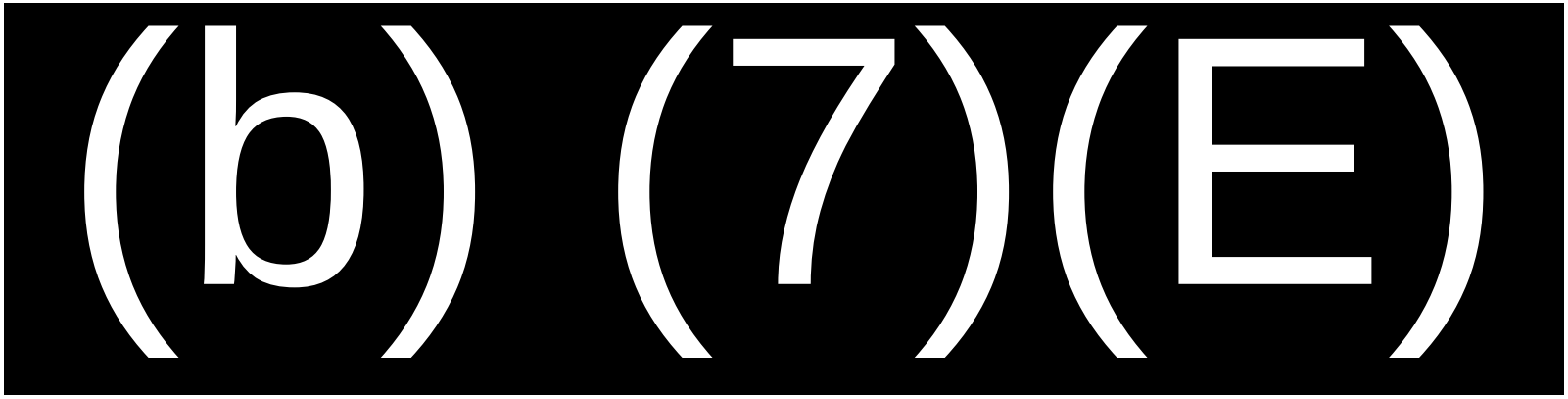
Risks Not Included in Monte-Carlo Simulation

Alternative	Source(s) of Cost Risk	Potential Impact	Comment
[General]	(b) (7)(E)		
Alt 1 (Agent-Centric)			
Alt 2 (Fixed)			
Alt 3 (Ground-Mobile)			
Alt 4 (Aviation-UAS)			
Alt 5 (Aerostat)			

Inputs

Allocation of Costs to Analysis Areas

- **Definitions:**
  - "Allocable" costs can be attributed specifically to the decision to use a given system *in a certain analysis area*
  - "Non-allocable" costs cannot be so attributed
- **Examples:**



Both "Inputs" and "Results" delineate these two types of costs separately

Inputs

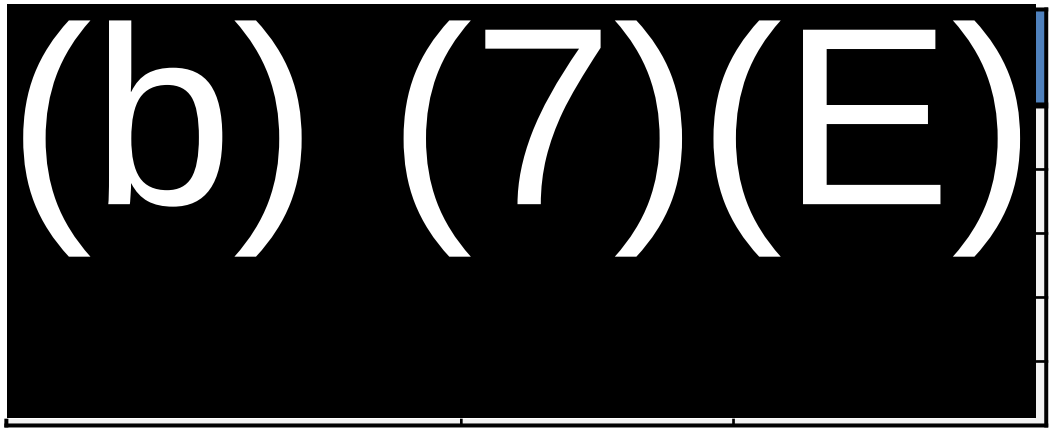
General

- **Labor Hours**
  - 1 Full-Time Equivalent (FTE) = 1,824 hours per year
  - Corollary: one-person coverage on a 24/7 basis is equivalent to (365 x 24) / 1,824 = 4.8 FTEs
- **Labor Rates**
  - Border Patrol Agents, COP operators, and vehicle / system operators: $70,000 per year (GS 12-5 equivalent), plus 30% fringe
  - Software refresh / maintenance: $188 per hour
- **Initial Sparing**
  - Approximately 30% of primary mission equipment acquisition cost

Inputs

Alt 1 (Agent-Centric) - Allocable

- **Equipment quantities**



(b) (7)(E)

- **Each equipment set includes**
  - (b) (7)(E)
  -
  -
- **All equipment purchased in FY11 (replaces current inventory)**

Inputs

Alt 2 (Fixed) - Allocable

- (b) (7)(E)

Analysis Area	Quantity
(b) (7)(E)	

Approx Unit Cost* ($K) →	(b) (7)(E)

(b) (7)(E)

(b) (7)(E)

- **COP operators**
  - (b) (7)(E)

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Inputs

Alt 2 (Fixed) – Allocable (cont)

- (b) (7)(E)

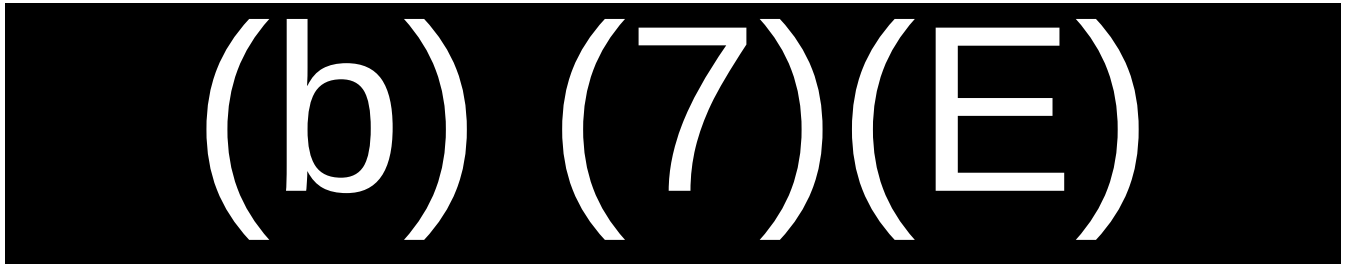
Item	Estimated Cost ($K)	Comments
(b) (7)(E)		

- (b) (7)(E)

Inputs

Alt 2 (Fixed) – Non-Allocable

- **IT Infrastructure costs**
  - Hardware
    - Quantities and costs per 2009 Program Bill of Materials (PBOM)
    - Tech Refresh rates based on (b) (7)(E) [redacted])
  - Software
    - Centrally managed software maintenance; assumptions:



    - Software license costs, renewed annually; costs per 2008 PBOM

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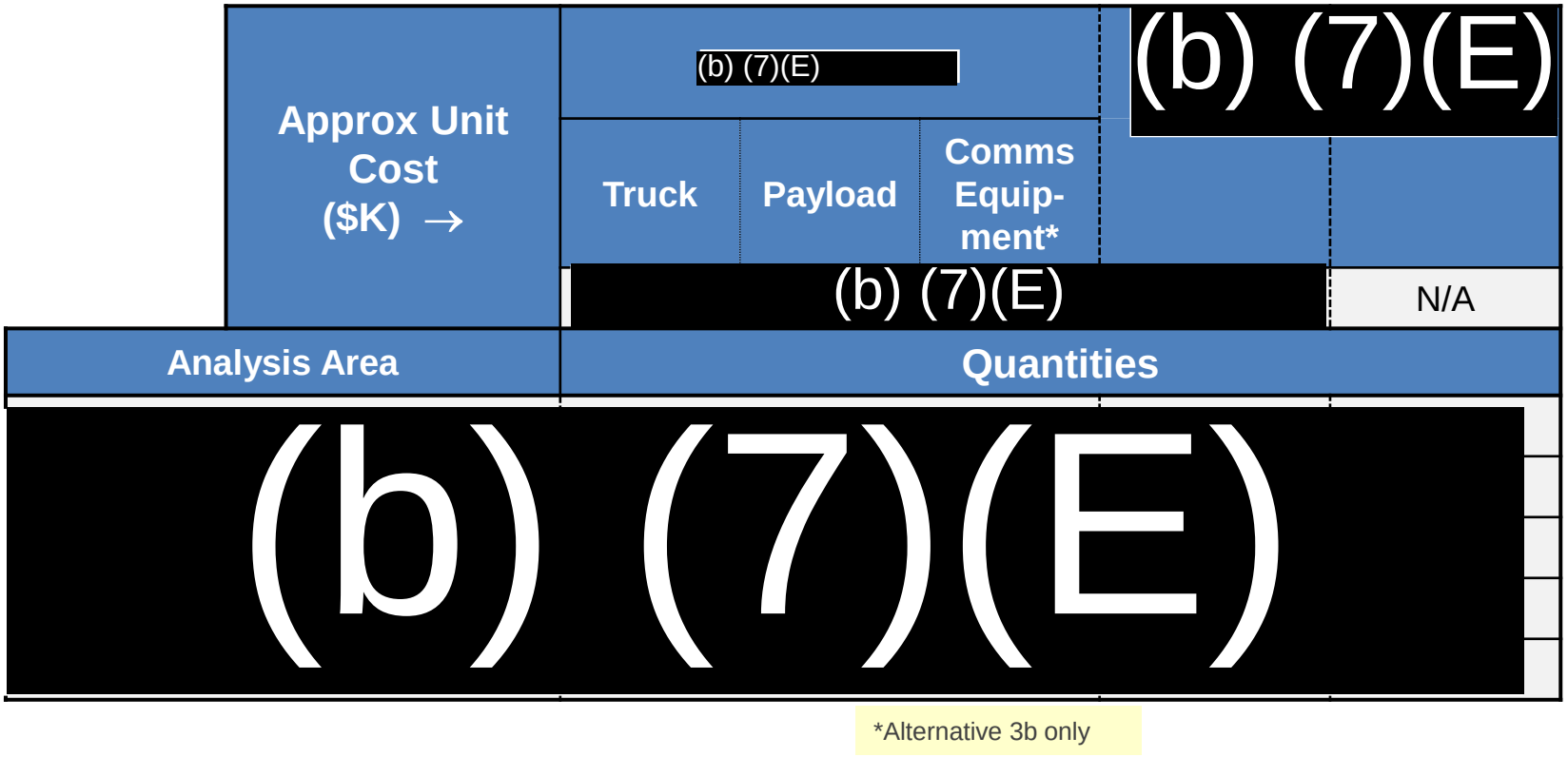
Inputs

Alt 3 (Ground-Mobile) - Allocable

- **Equipment quantities and unit costs**



*Alternative 3b only

- **Vehicle operations and maintenance**
  - Mean time between failure (MTBF): (b) (7)(E))
  - Fuel: 12 gal / day per vehicle

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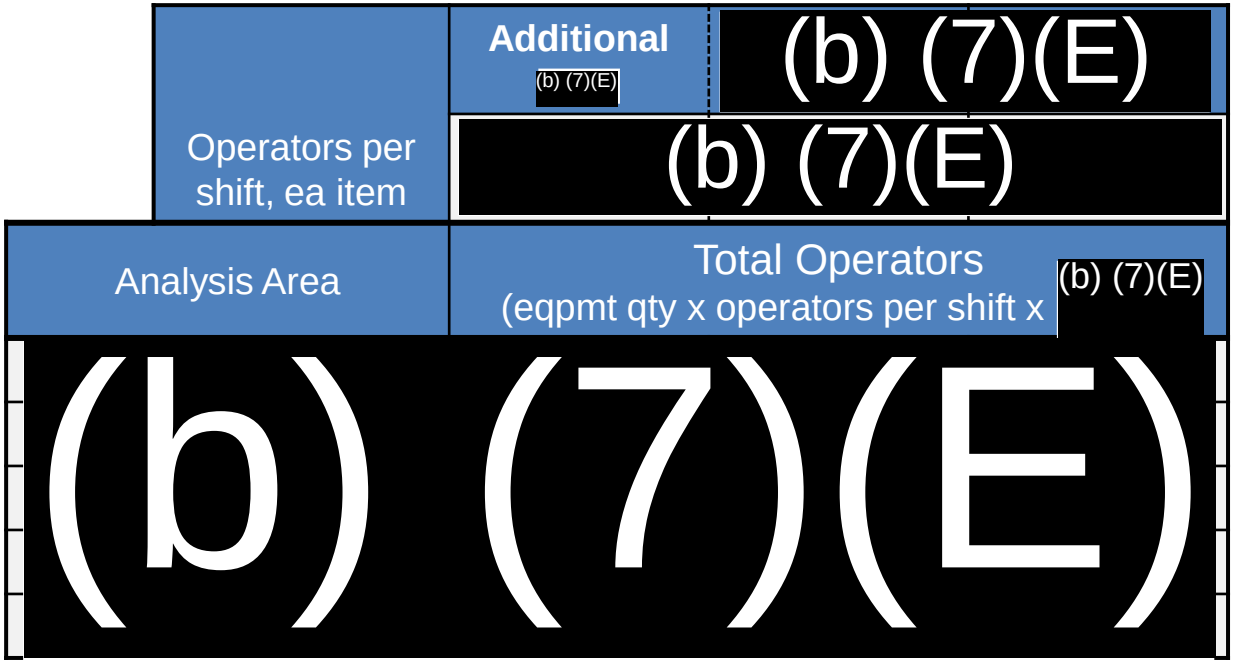
Inputs

Alt 3 (Ground-Mobile) - Allocable

- **Additional operators**
  - Number of operators derived from equipment quantities



BW FOIA CBP 003433

Inputs

Alt 4 (Aviation-UAS) – Non-Allocable

- **Acquisition** (b) (7)(E)
  - Assumptions: (b) (7)(E)

Item	Quantity	Unit Cost ($K)	Comments
(b) (7)(E)			

- (b) (7)(E)

BW FOIA CBP 003434

Inputs

Alt 4 (Aviation-UAS) - Allocable

- **Flying-hour costs**
  - 455 annual fh per UAS
  - $3,234 per fh (provided by CBP); includes
    - Flight crew
    - Operations
    - Fuel
    - Two-level UAS maintenance (operational and depot-level, both contractor-managed)

Inputs

Alt 5 (Aerostat) – Non-Allocable

- **Acquisition: Development**
  - 24-month (b) (7)(E) development/integration
  - (b) (7)(E)
  - Assumptions:
    - (b) (7)(E)

Inputs

Alt 5 (Aerostat) – Allocable

- **Acquisition: Production**
  - Aerostat systems are procured in 2013
  - Quantities and approximate unit costs shown below

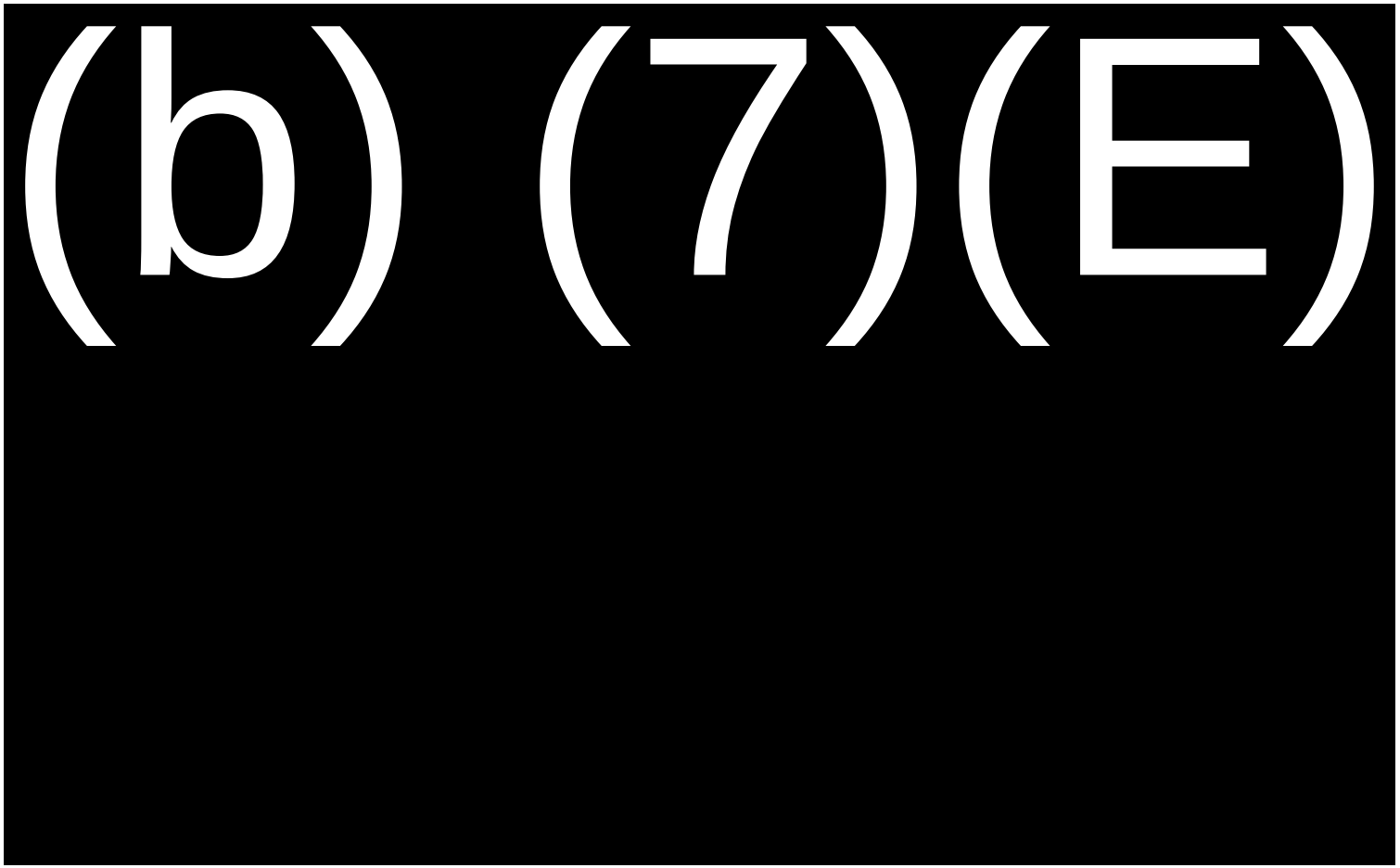
Analysis Area	Quantity
(b) (7)(E)	(b) (7)(E)

Item	Unit Cost ($K)
(b) (7)(E)	

Inputs

Alt 5 (Aerostat) – Allocable (cont)

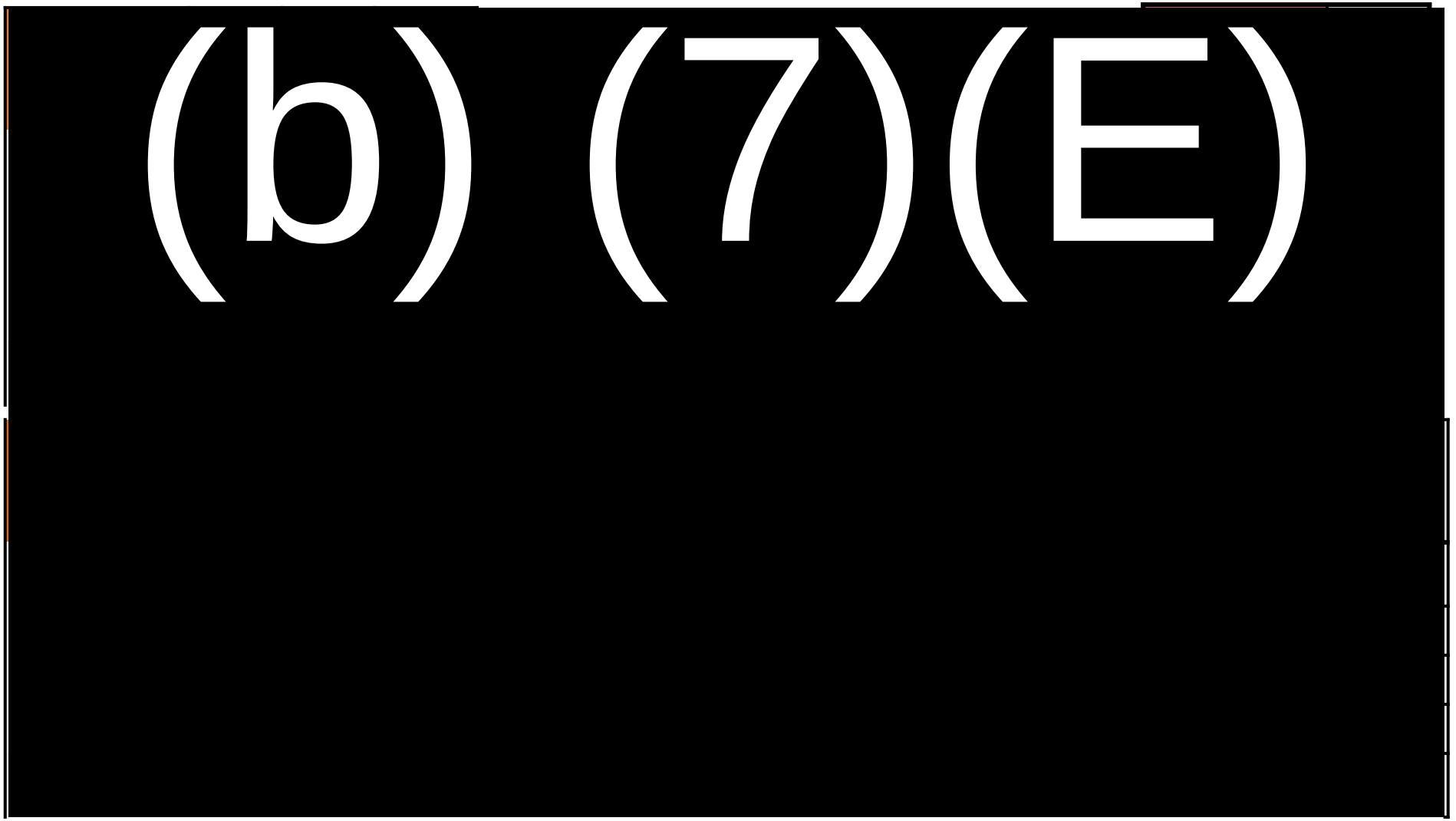
- **Operations and Support**
  - (b) (7)(E)
  -



BW FOIA CBP 003438

Results: Summary

(b) (7)(E) Life Cycle Cost Estimate, Then-Year $M



BW FOIA CBP 003439

Results: Comparison

AoA Phase IB vs IA

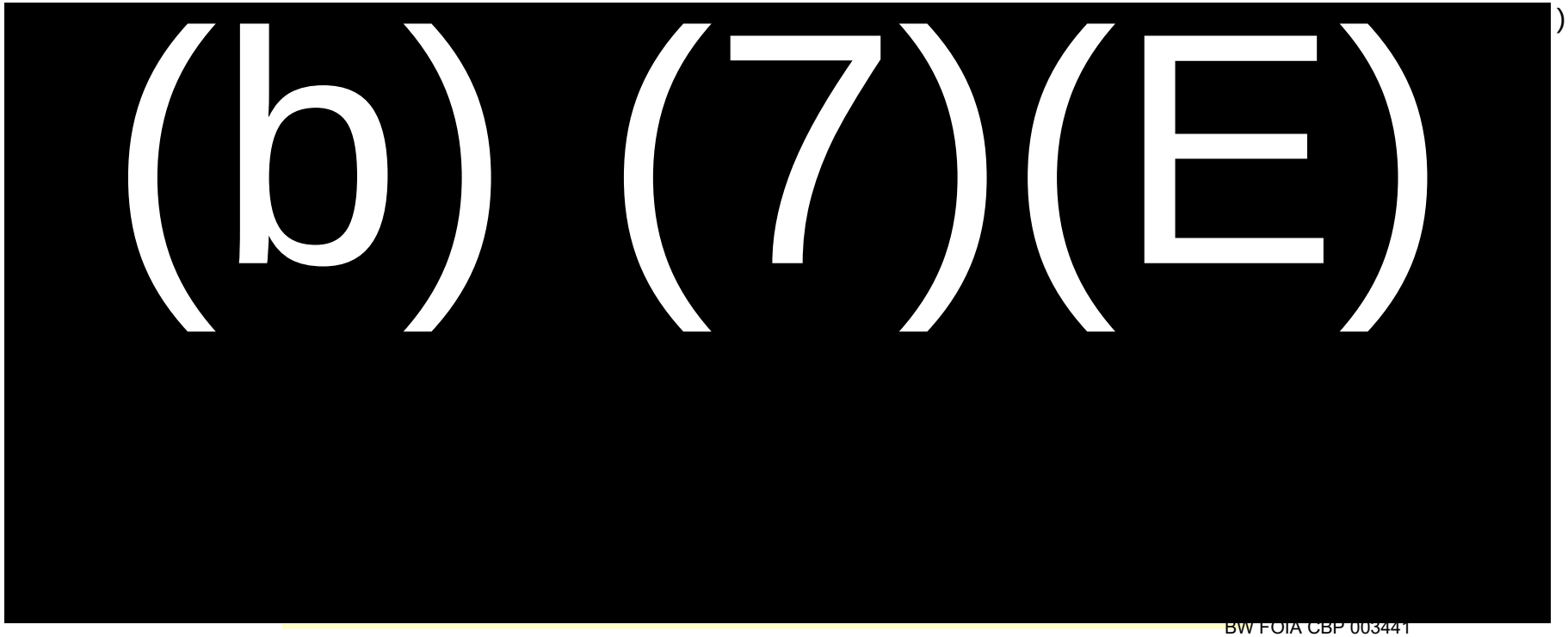
Item	Net Change in Cost for Nominal Quantity / Configuration (from AoA Phase IA to Phase IB)	Comments*
(b) (7)(E)		

(b) (7)(E)

Results

Cost Risk and "Allocation Uncertainty"

- **Problem: how to depict Non-Allocable costs in a comparison of individual Station / Analysis Area results**
- **Solution: for Area X…**



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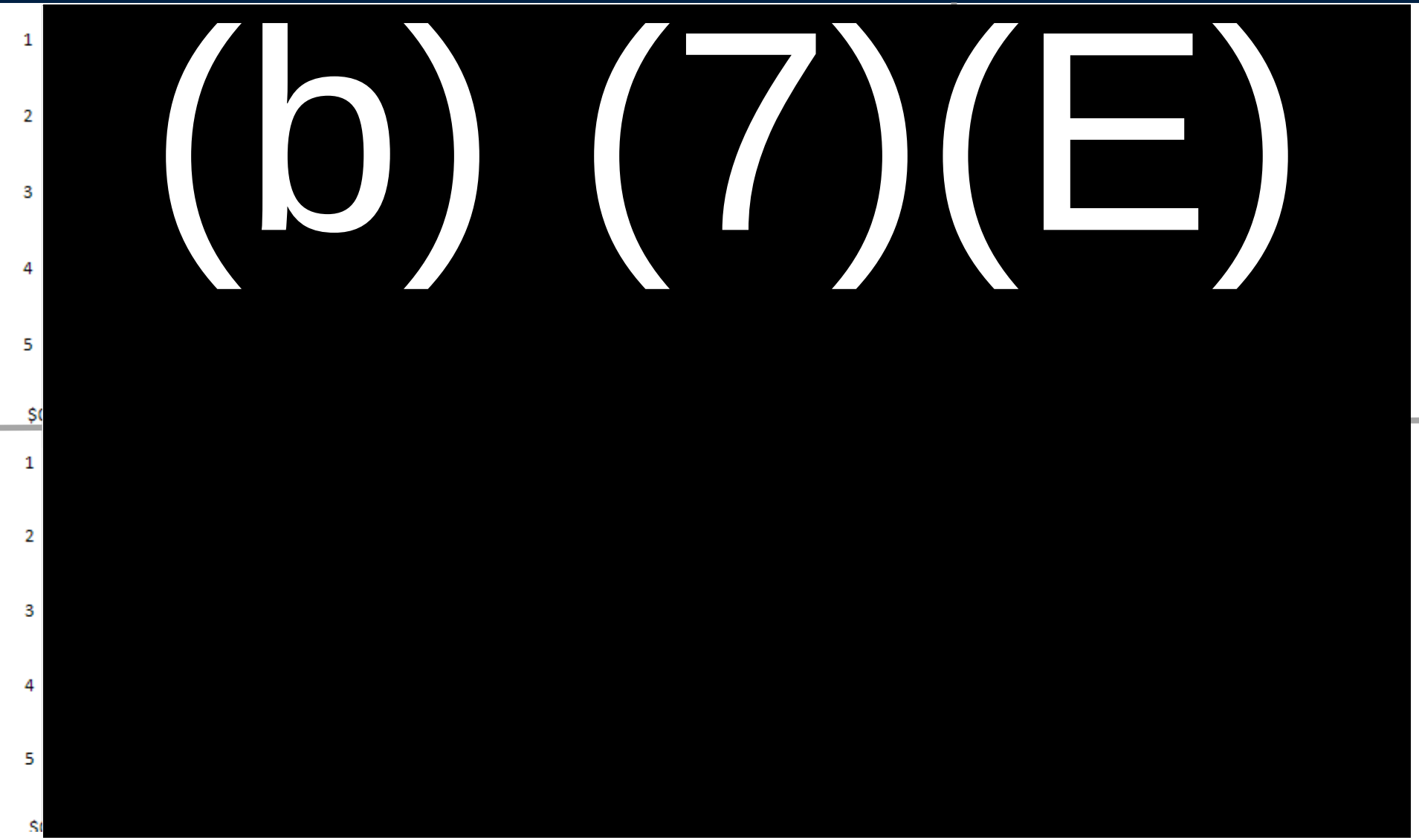
Results: Summary

Allocation Uncertainty Dominates the Comparison



Summary Observations

Cost Analysis – Uncertainty

- **The cost comparison is significantly impacted by the "allocation uncertainty"**
  - Comparing the cost of Alts 2 (Fixed Tower, with COP) and 4 (Aviation – UAS) to the cost of other technology solutions *for one particular station or area* is difficult without knowing how broadly the fixed (nonallocable) costs will be distributed
  - Unlike operational effectiveness comparisons, which are driven by local (station or area-unique) variables, cost comparisons are driven by the larger "game plan"

Summary Observations

Cost Comparison of Alternatives

- **Alt 1 (Agent-Centric)**
  - (b) (7)(E)
- **Alt 2 (Fixed)**
  - (b) (7)(E)
  -
- **Alt 3 (Ground-Mobile)**
  - (b) (7)(E)
  -
- **Alt 4 (Aviation-UAS)**
  - (b) (7)(E)
  -
- **Alt 5 (Aerostat)**
  - (b) (7)(E)

(b) (7)(E)

BW FOIA CBP 003444

Outline

- **Introduction**
- **Alternatives**
- **Effectiveness Analysis**
- **Cost Analysis**
- **Summary**
  - Cost-Effectiveness Comparisons
  - OBP Technology Deployment Plans
- **Additional Topics**

Cost Effectiveness Comparison

Approach for a Single Study Area

(b) (7)(E)

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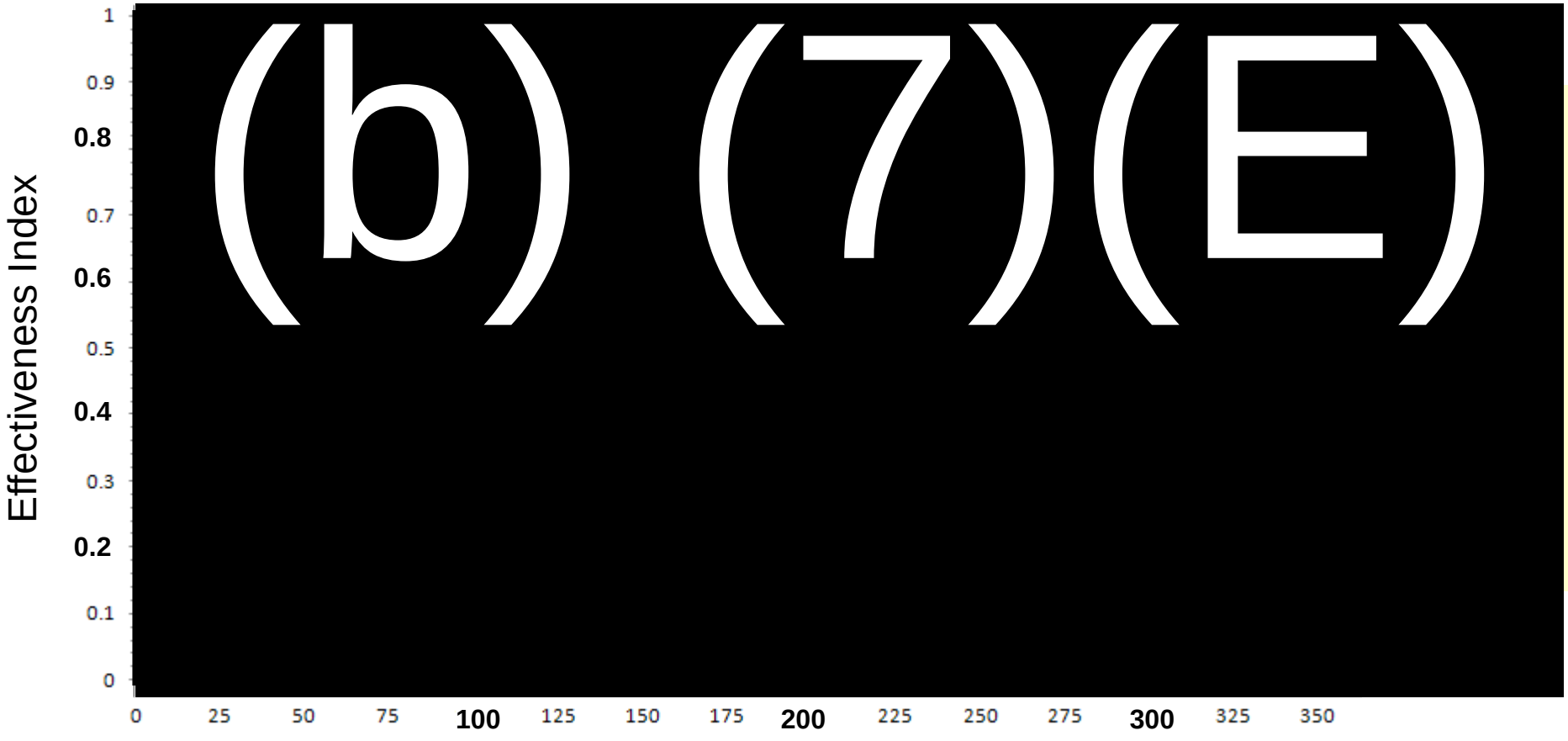
Cost-Effectiveness Comparison

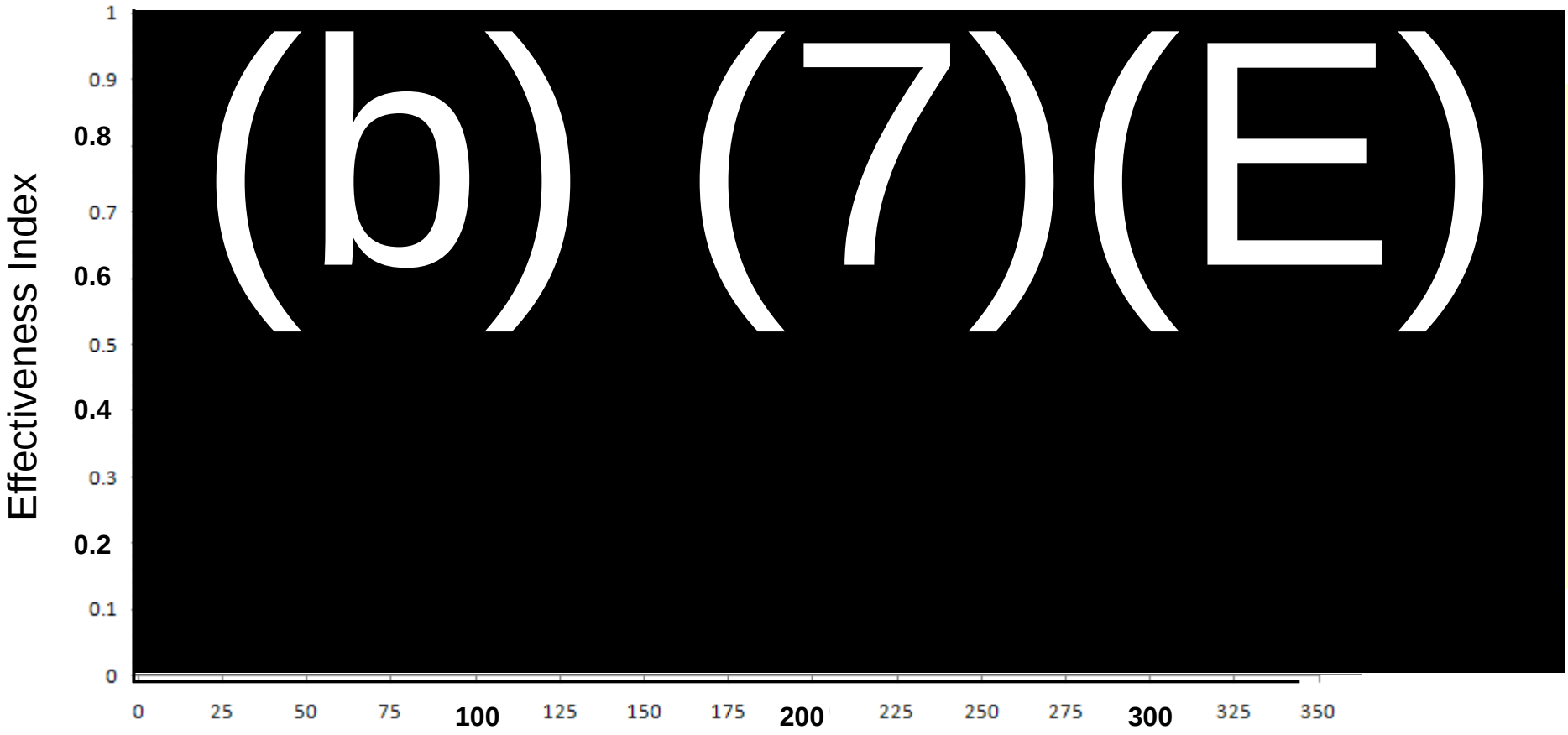
(b) (7)(E)



BW FOIA CBP 003447

Cost-Effectiveness Comparison

(b) (7)(E)



(b) (7)(E) Life-Cycle Cost, Then-Year $M

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Cost-Effectiveness Comparison

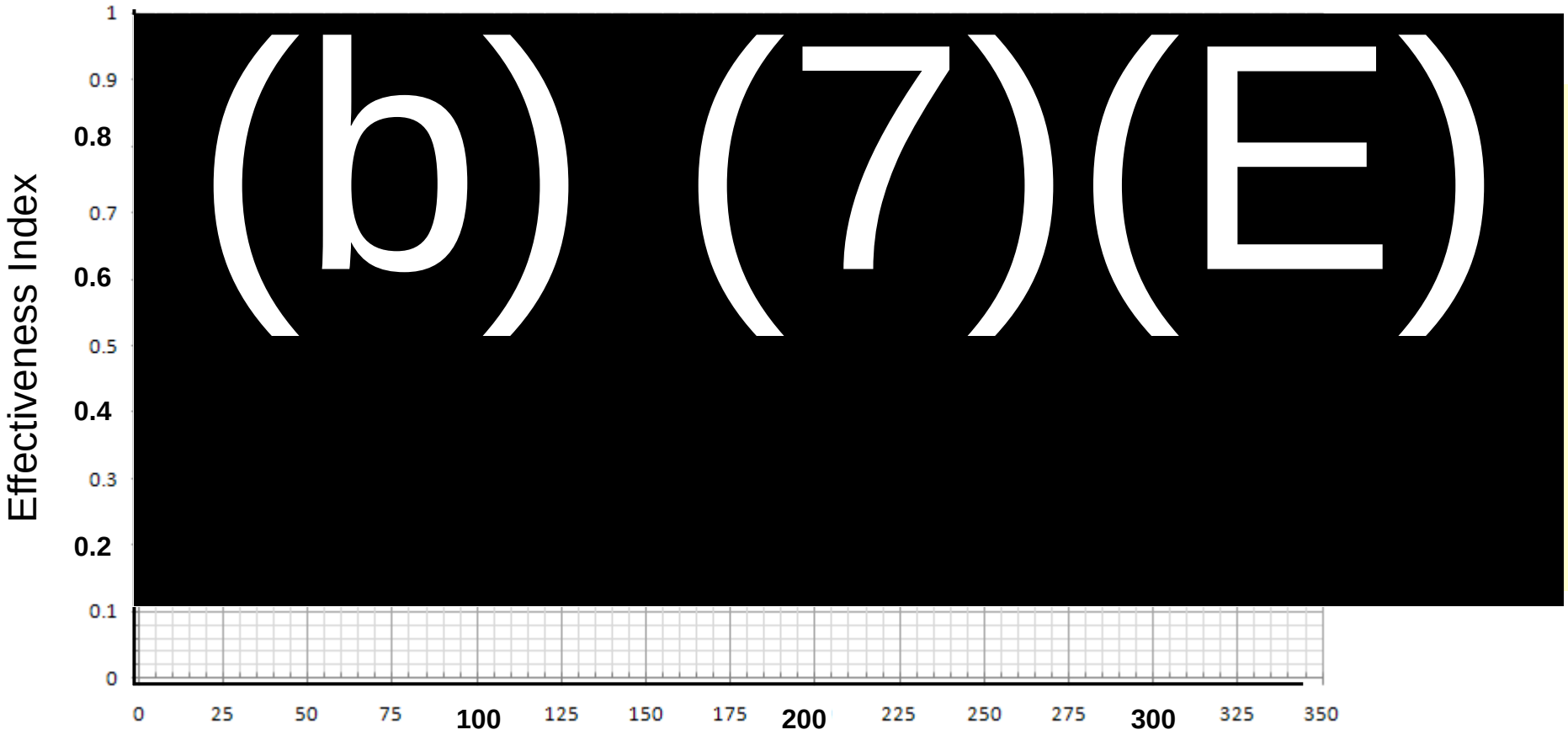
(b) (7)(E)

(b) (7)(E) ife-Cycle Cost, Then-Year $M

BW FOIA CBP 003449

Cost-Effectiveness Comparison

(b) (7)(E)



(b) (7)(E) Life-Cycle Cost, Then-Year $M

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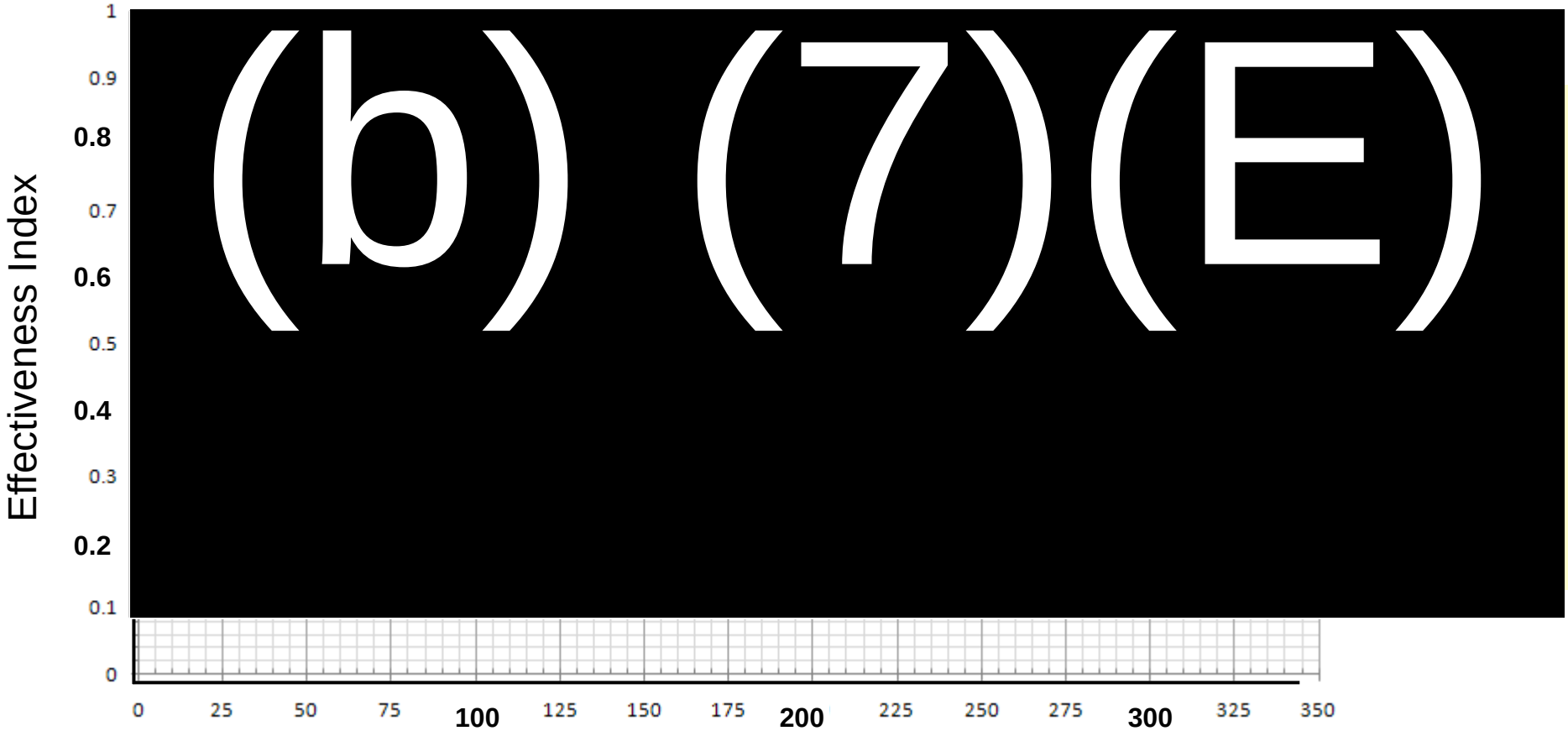
Cost-Effectiveness Comparison

(b) (7)(E)



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Cost-Effectiveness Comparison

Summary Observations

- **With regard to the decision focus of Phase IB (factors that influence the choice of technology alternatives):**

Technology (Platform)	Key Considerations
(b) (7)(E)	

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OBP Technology Deployment Plans

Relationship to AoA Phase IB

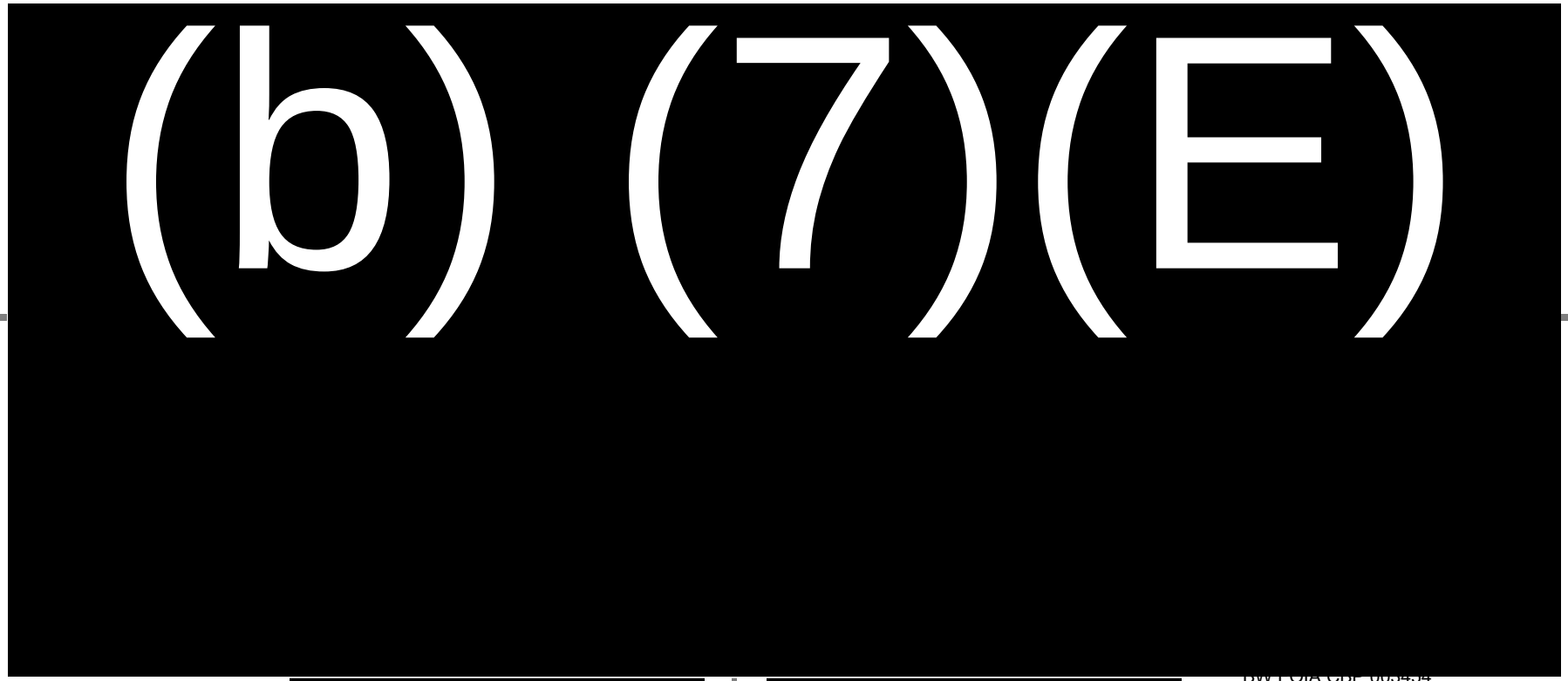
- **Interim AoA Phase IB results were presented to sector/station personnel as input to their development of Technology Deployment Plans**
  - San Diego: 13-14 Dec 10
  - El Paso: 16-17 Dec 10
  - RGV: 20-21 Dec 10
- **The OBP Technology Deployment Plans…**
  - (b) (7)(E)
  -
  -

BW FOIA CBP 003453

Comparison

AoA vs OBP Technology Deployment Plans

- **Direct comparison is not straightforward**
  - Purpose and scope were not the same
  - The AoA was designed to provide *input* to the Technology Deployment Plans, not to produce or predict their output



Results of Comparison

AoA vs OBP Technology Deployment Plan – Area G

Measure	Weight	AoA Alt 2		OBP Plan		Comments
		Low	High	Low	High	
MOE 1.0: …Persistent Surveillance						
MOE 2.0: …Timely / Effective Response						
MOE 3.0: … Other Mission Elements						
MOE 4.0: …Agile / Supportable Capability						
MOE 5.0: …Strategic Intelligence						
MOE 6.0: … Dynamic Surveillance						
Situational Awareness (Weighted Sum)						

(b) (7)(E)

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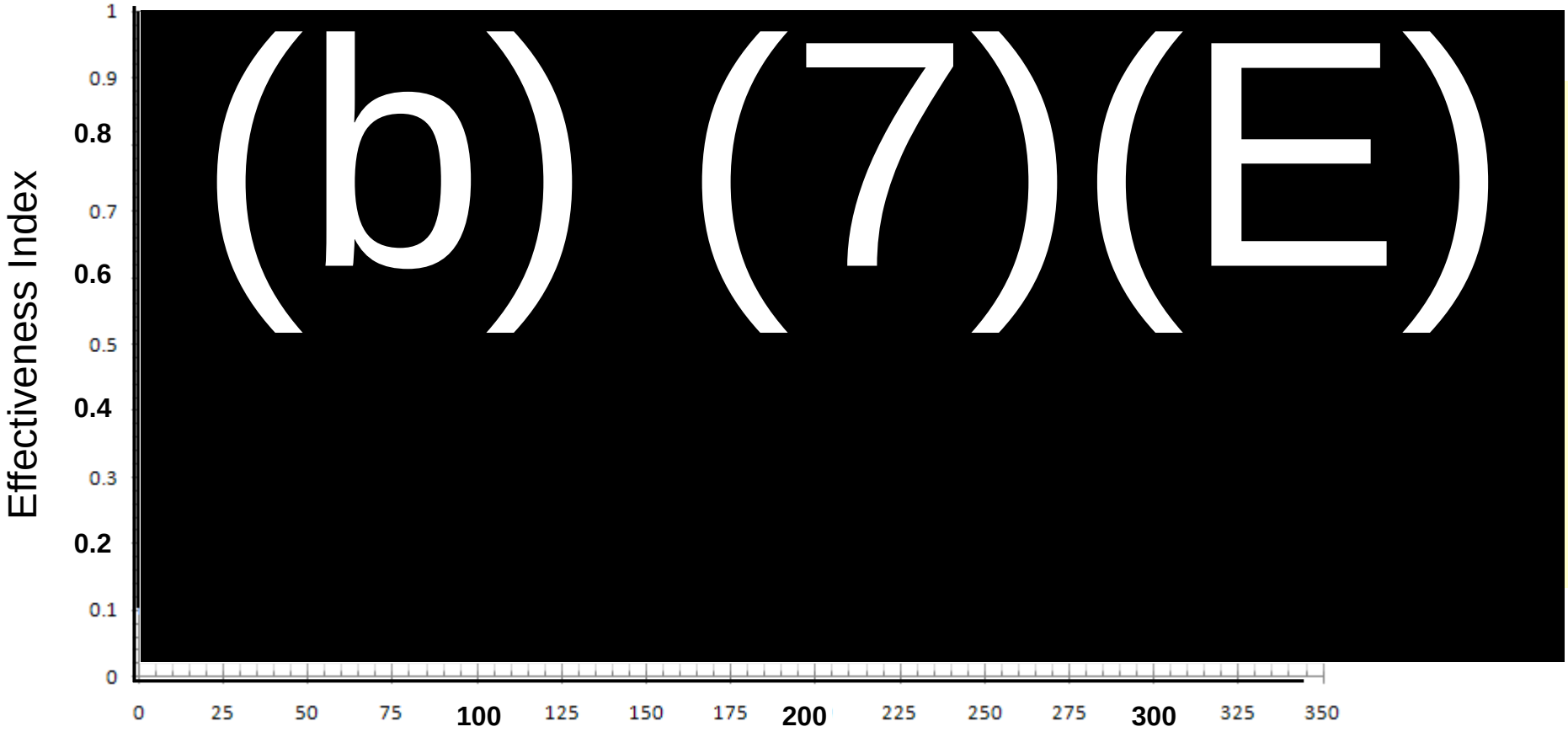
Results of Comparison

Cost-Effectiveness: OBP Tech Plan vs AoA Alternatives



BW FOIA CBP 003456

Outline

- **Introduction**
- **Alternatives**
- **Effectiveness Analysis**
- **Cost Analysis**
- **Summary**
- **Additional Topics**
  - Implications for Future Systems
  - Analysis of Urban Areas

Future Systems

Desirable Characteristics

- (b) (7)(E)
-
-

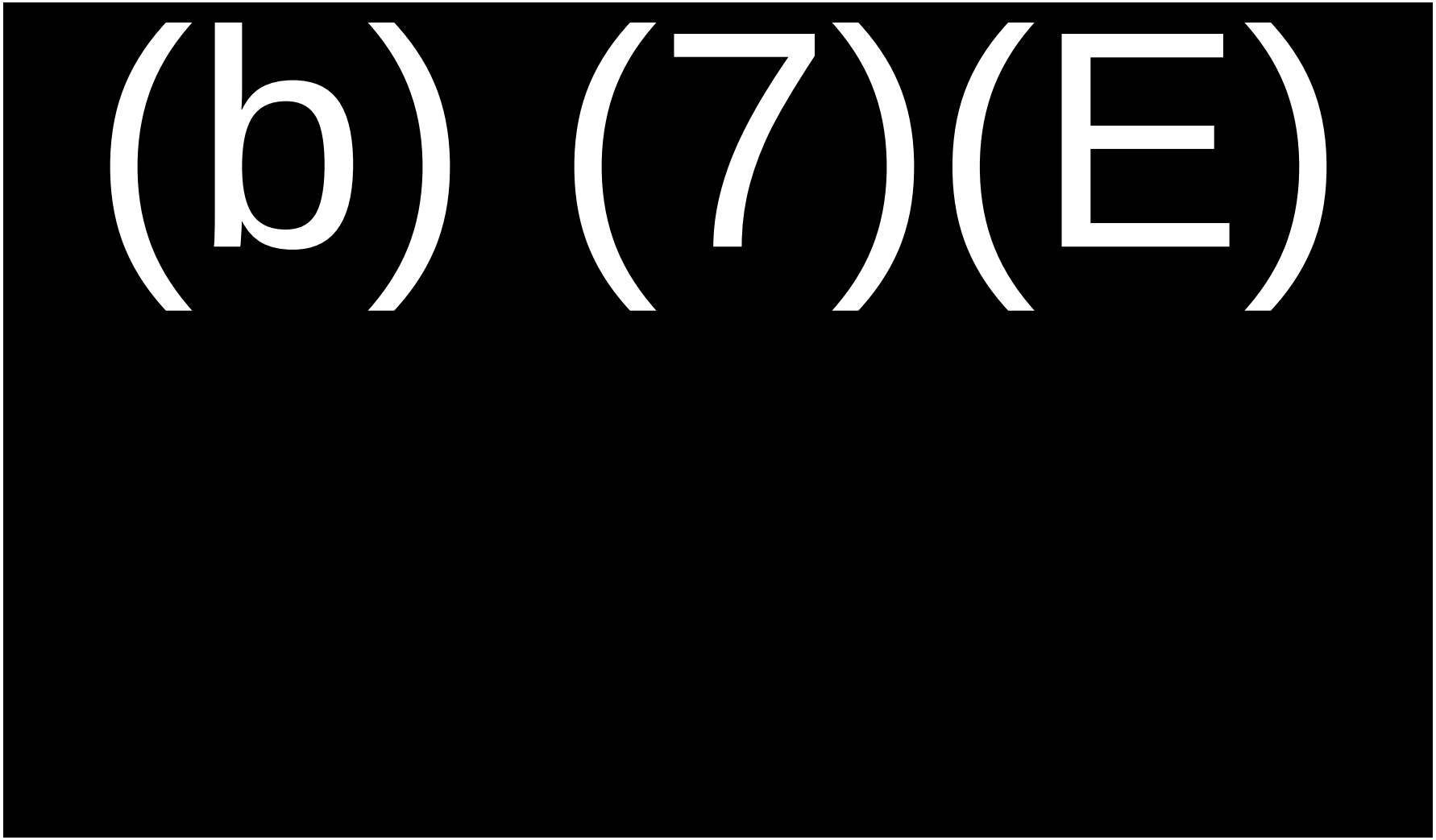
Analysis of Urban Areas

Basic Concept

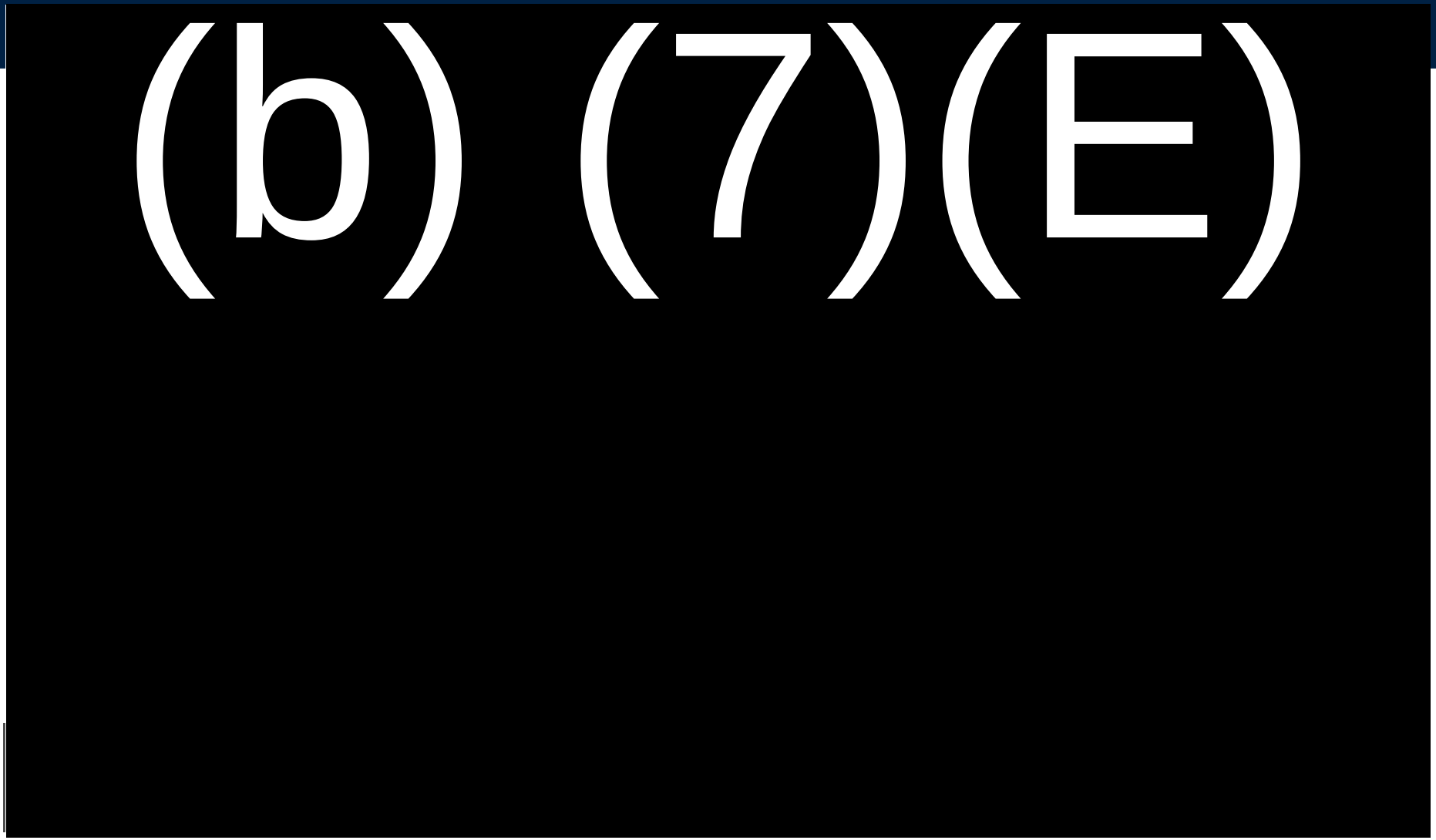
- (b) (7)(E)
-

Available Response Time

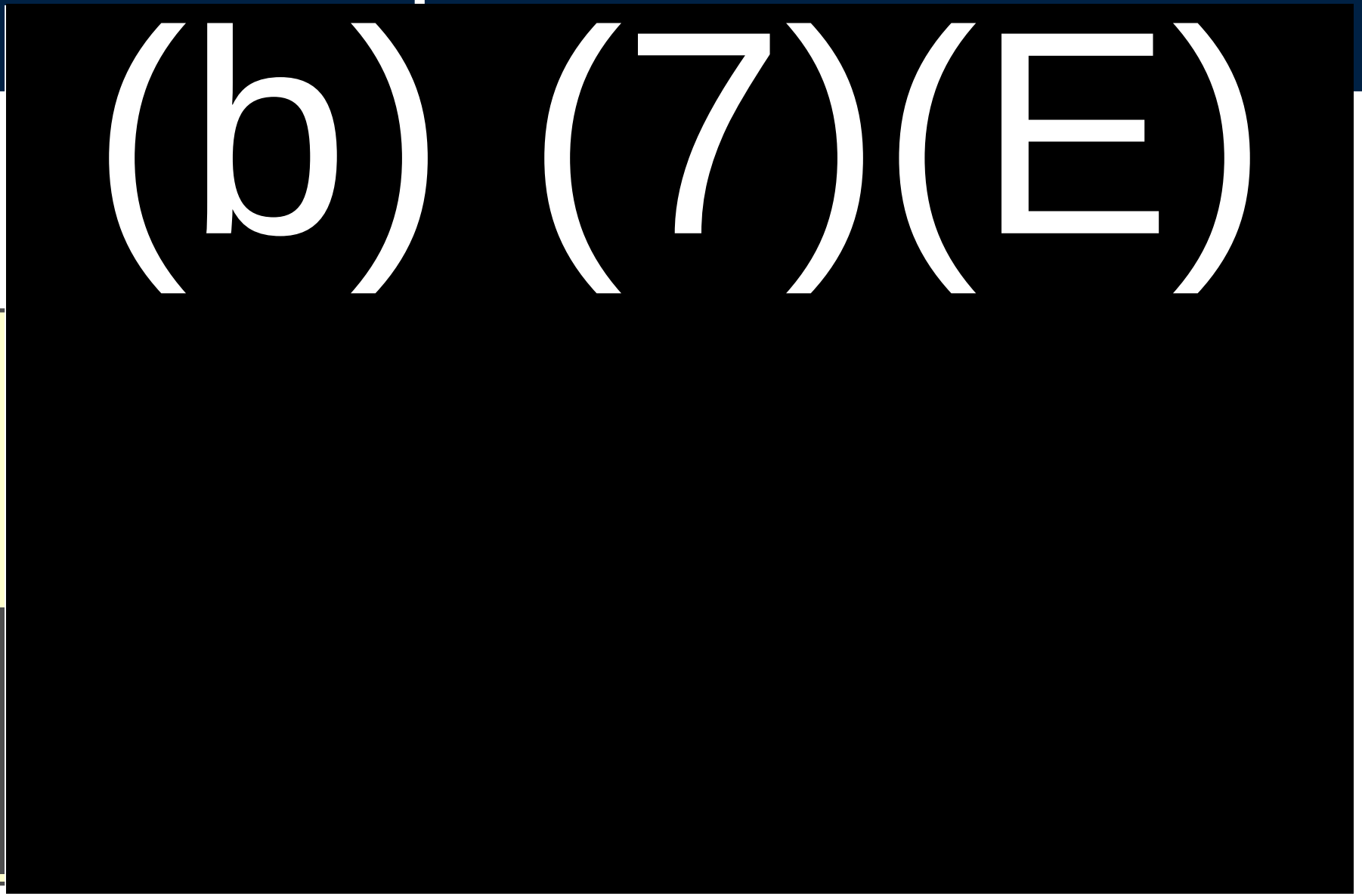
For One Crossing Point…



Crossing, Detection, and Transmit Times



Response Time Profile



Urban MOEs

MOEs are Statistics (b) (7)(E)

(b) (7)(E)

Urban MOEs (cont)

Some Statistics Defy Closed-Form Expression

(b) (7)(E)

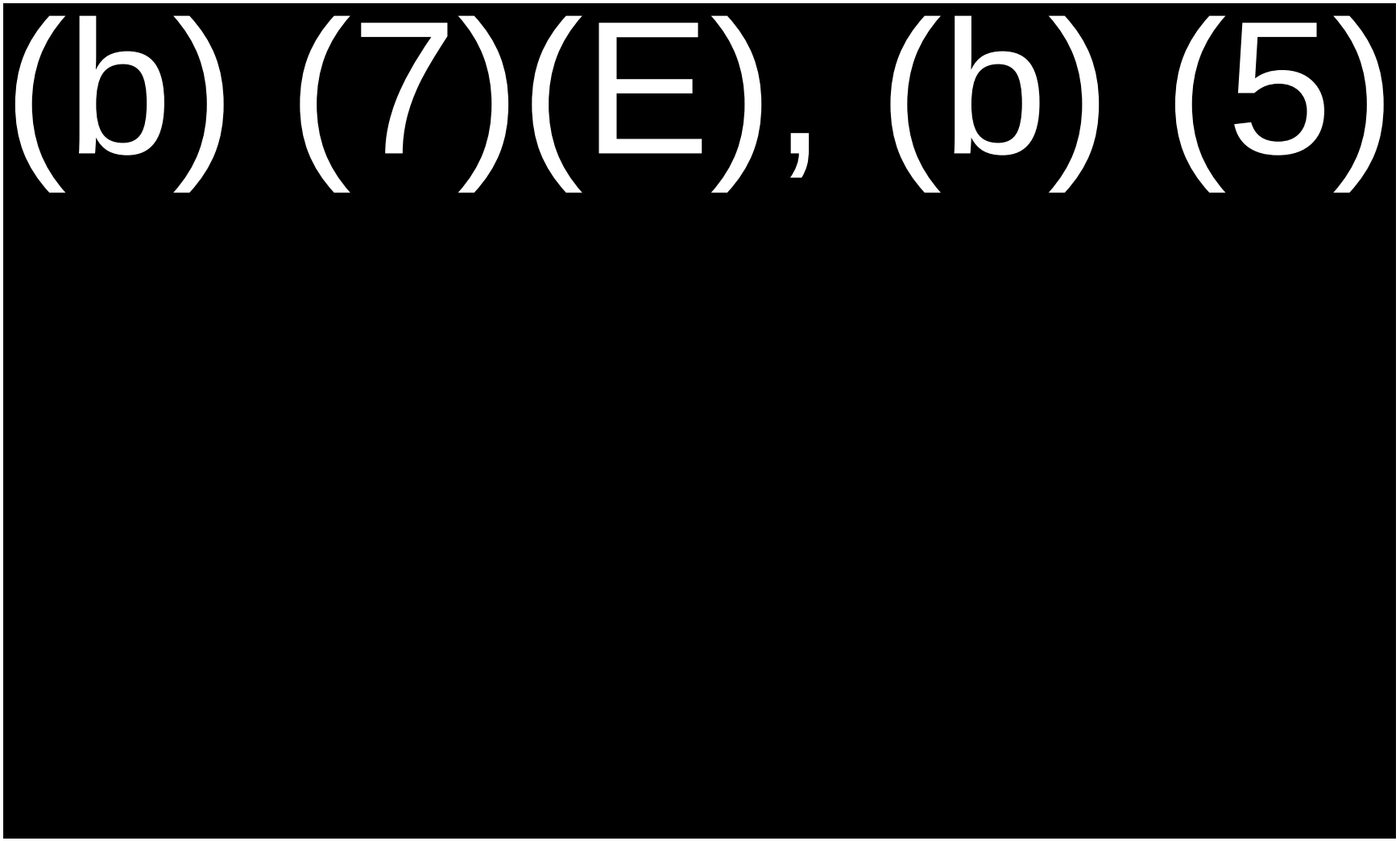
Other Possible Metrics

- (b) (7)(E)

Urban Area Analysis

Suggested Approach

- (b) (7)(E), (b) (5)
-
-



BW FOIA CBP 003466

Urban Area Analysis

Scope

- (b) (7)(E), (b) (5)
-

Urban Area Analysis

Other Questions That Will Need to be Addressed

- (b) (7)(E), (b) (5)

Urban Area Analysis

Other Questions (cont)

- (b) (7)(E), (b) (5)

HOMELAND SECURITY
STUDIES & ANALYSIS
INSTITUTE

An FFRDC operated by Analytic Services Inc on behalf of DHS

Evaluation: MOE1.0 (low)

(b) (7)(E)

	(b) (7)(E)	Persis-tence	Availability	Coverage (A=103mi^2)	Performance	Sub-total	MOE 1.0*
				(b) (7)(E)			
Alt 1 Agent	(b) (7)(E)						
Alt 2 Fixed							
Alt 3 Ground-Mobile							
Alt 4 Aviation (UAS)							
Alt 5 Aerostat							

(b) (7)(E)

BW FOIA CBP 003471

Evaluation: MOE1.0 (low)

(b) (7)(E)

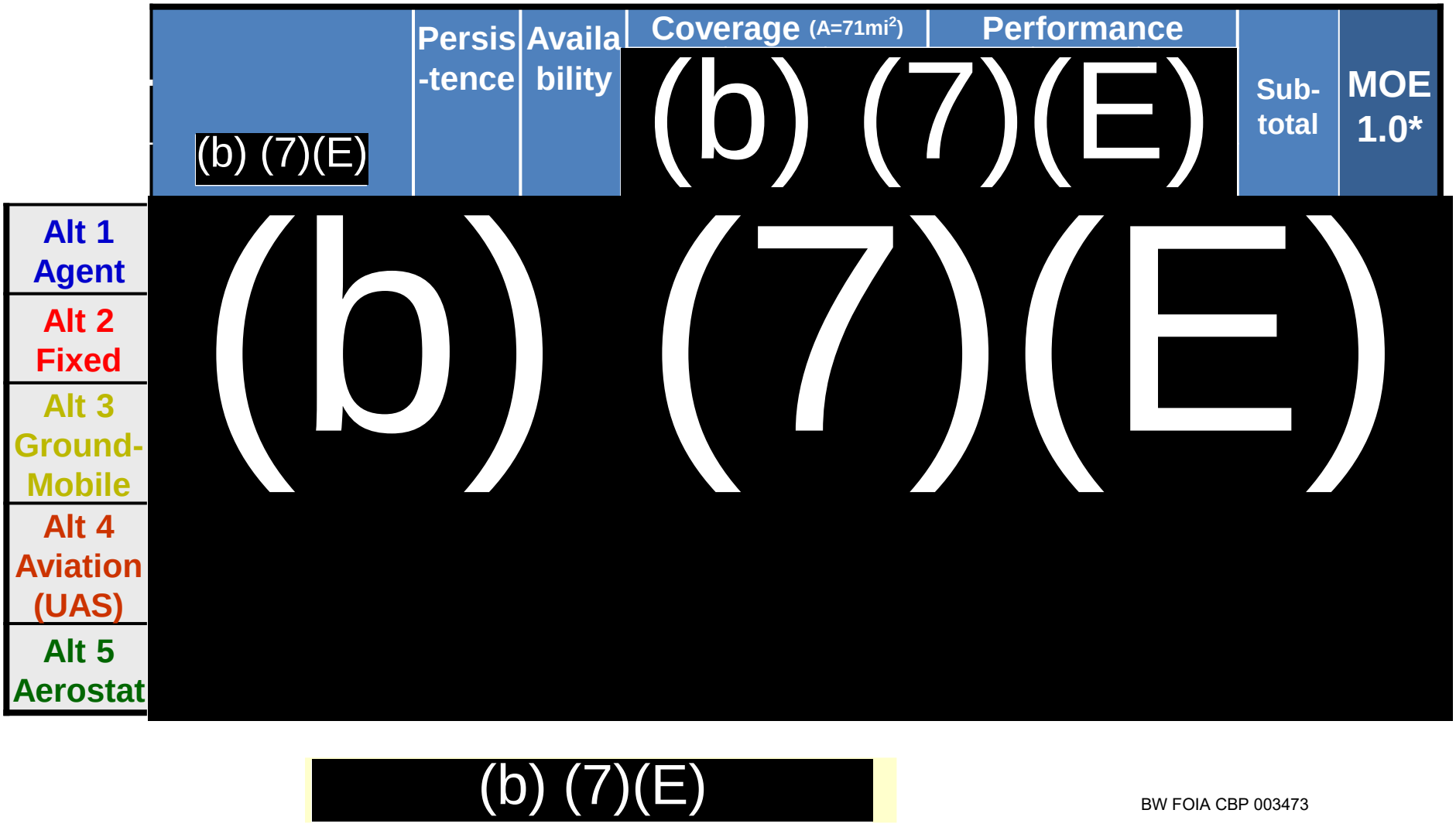
	(b) (7)(E)	Persis-tence	Availability	Coverage (A=105mi^2)	Performance	Sub-total	MOE 1.0*
				(b) (7)(E)			
Alt 1 Agent	(b) (7)(E)						
Alt 2 Fixed							
Alt 3 Ground-Mobile							
Alt 4 Aviation (UAS)							
Alt 5 Aerostat							

(b) (7)(E)

BW FOIA CBP 003472

Evaluation: MOE1.0 (low)

(b) (7)(E)



BW FOIA CBP 003473

Evaluation: MOE1.0 (low)

(b) (7)(E)

	(b) (7)(E)	Persis-tence	Availability	Coverage (A=2194mi²)	Performance	Sub-total	MOE 1.0†
Alt 1 Agent	(b) (7)(E)						
Alt 2 Fixed							

(b) (7)(E)

Evaluation: MOE1.0 (low)

(b) (7)(E)

	(b) (7)(E)	Persis-tence	Availability	Coverage (A=2194mi²)	Performance	Sub-total	MOE 1.0†
Alt 3 Ground-Mobile	(b) (7)(E)						
Alt 4 Aviation (UAS)							
Alt 5 Aerostat							

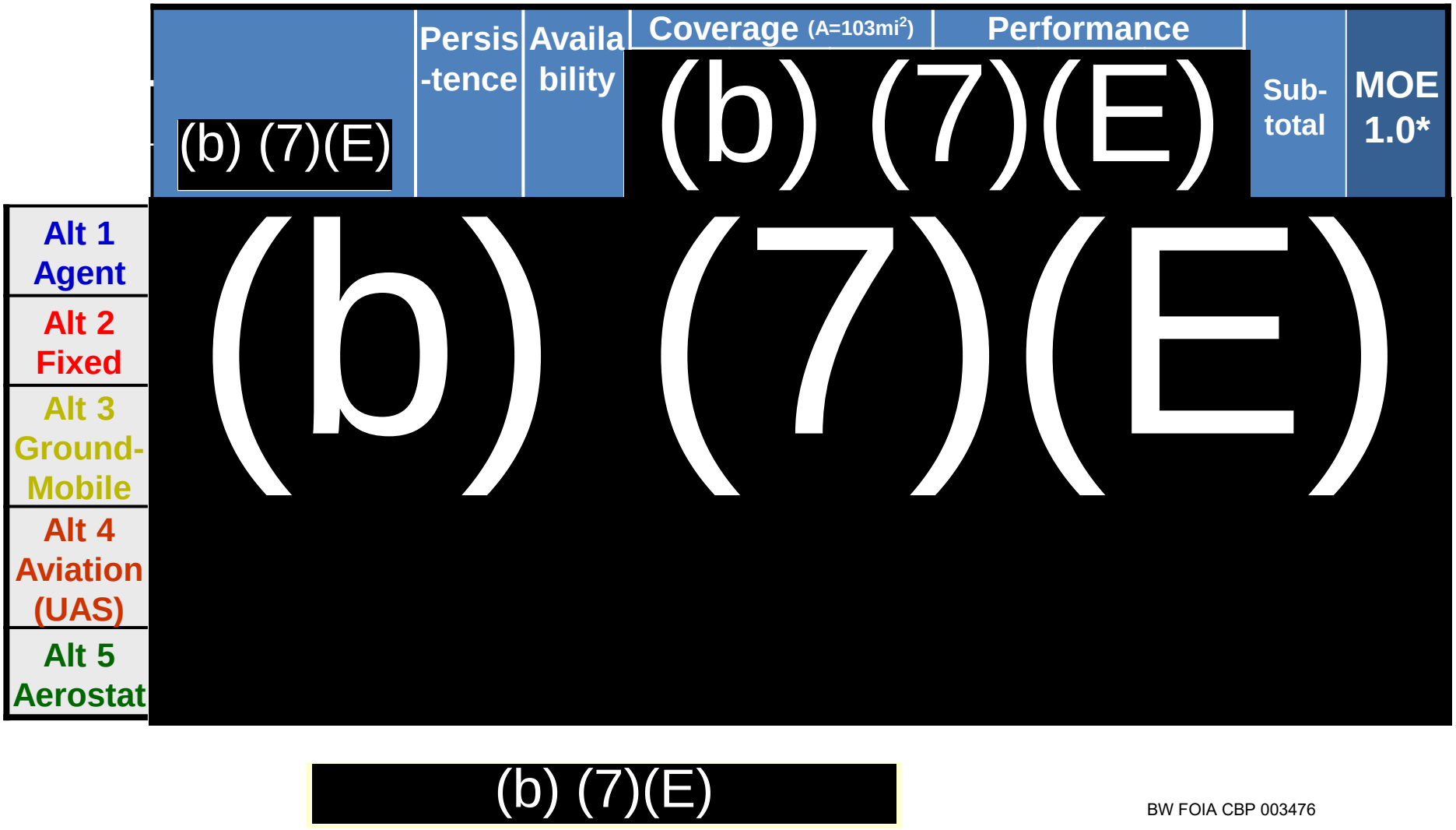
*Due to overlaps of dissimilar systems, non-persistence is treated as an independent failure term

†For Alts 2-5, includes a (b) (7)(E)

(b) (7)(E)

Evaluation: MOE1.0 (high)

(b) (7)(E)



(b) (7)(E)

BW FOIA CBP 003476

Evaluation: MOE1.0 (high)

(b) (7)(E)

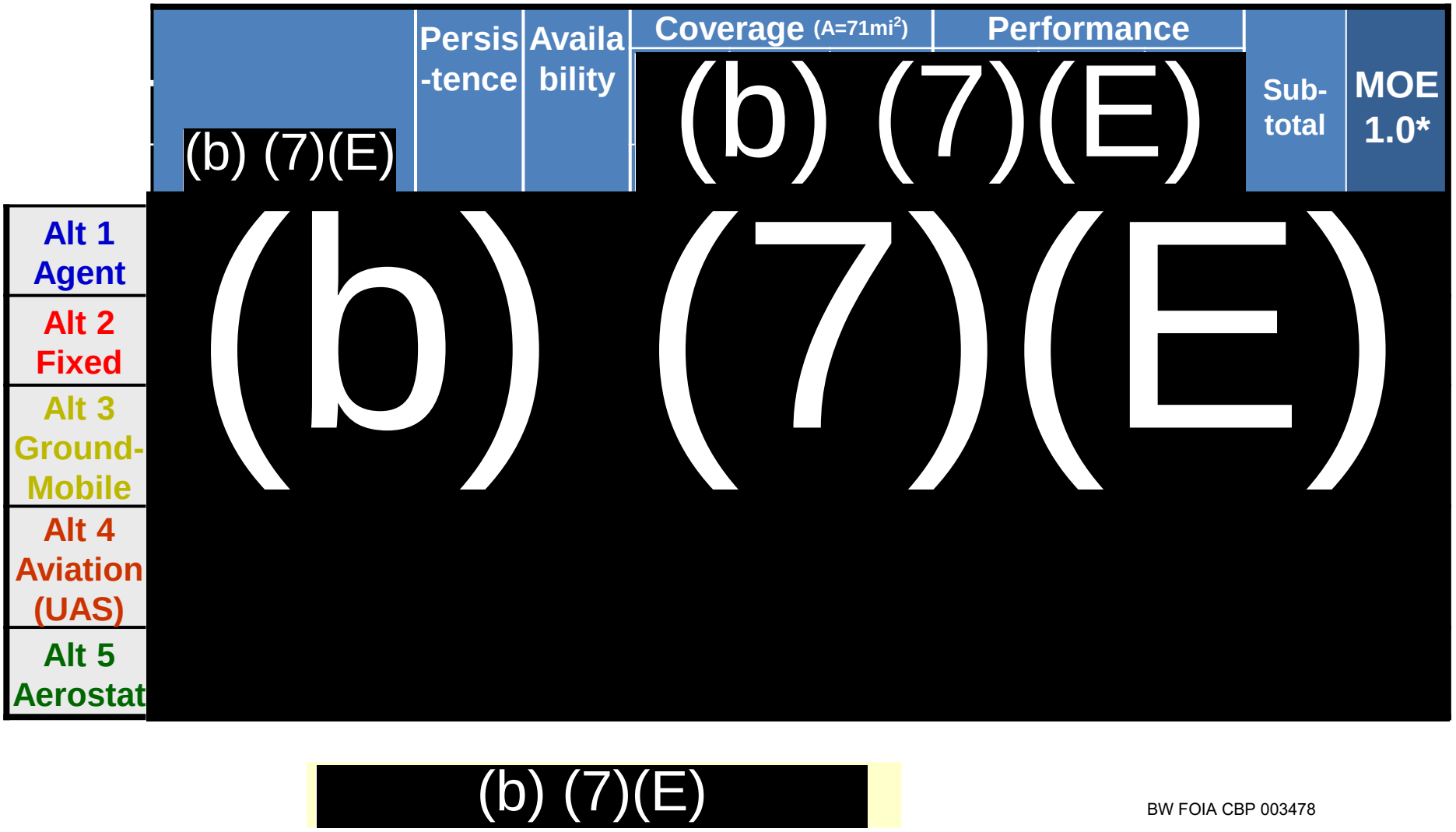
	(b) (7)(E)	Persis-tence	Availability	Coverage (A=105mi^2)	Performance	Sub-total	MOE 1.0*
				(b) (7)(E)			
Alt 1 Agent	(b) (7)(E)						
Alt 2 Fixed							
Alt 3 Ground-Mobile							
Alt 4 Aviation (UAS)							
Alt 5 Aerostat							

(b) (7)(E)

BW FOIA CBP 003477

Evaluation: MOE1.0 (high)

(b) (7)(E)

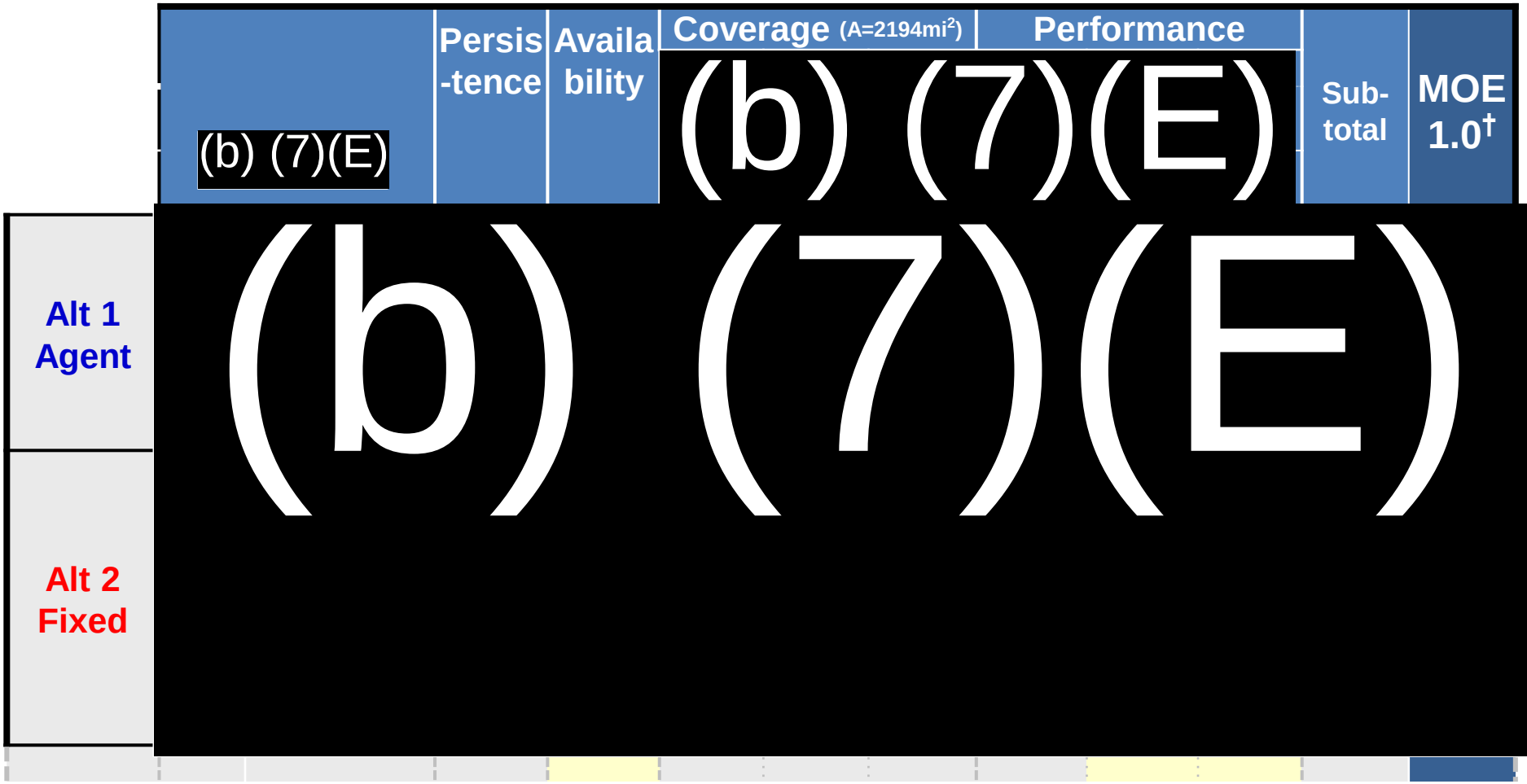


(b) (7)(E)

BW FOIA CBP 003478

Evaluation: MOE1.0 (high)

(b) (7)(E)



(b) (7)(E)

Evaluation: MOE1.0 (high)

(b) (7)(E)

	(b) (7)(E)	Persis-tence	Availability	Coverage (A=2194mi²)	Performance	Sub-total	MOE 1.0†
Alt 3 Ground Mobile	(b) (7)(E)			(b) (7)(E)			
Alt 4 Aviation (UAS)							
Alt 5 Aerosta							

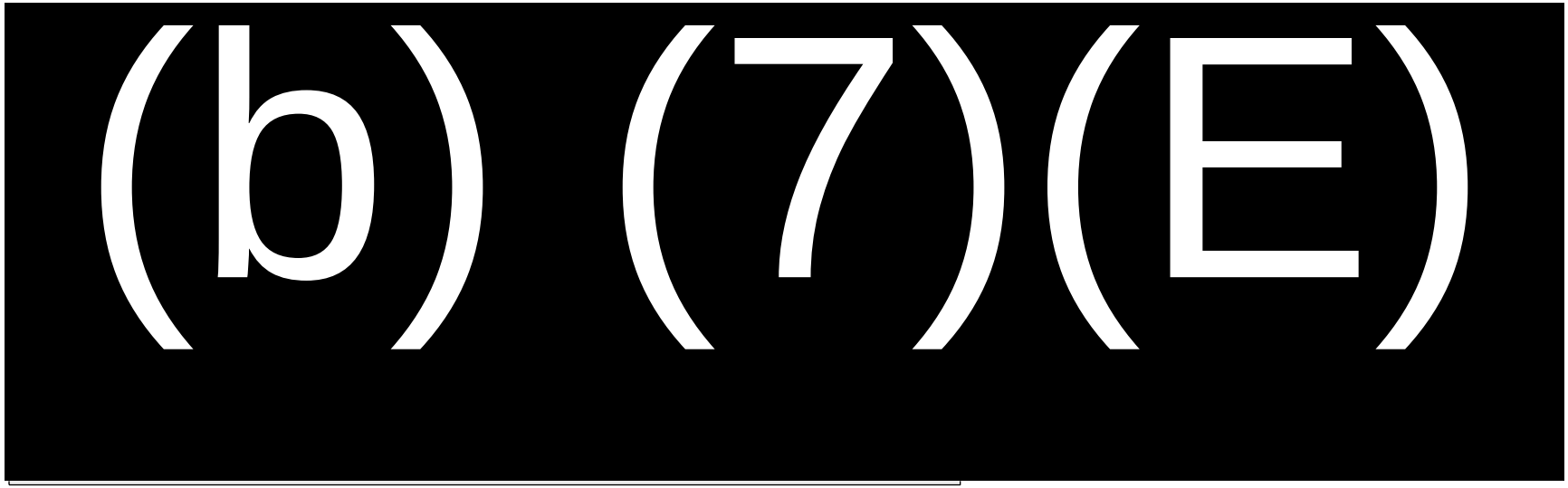
(b) (7)(E)

Interim Findings - Phase IB

- (b) (7)(E)

Detect, ID, Classify

Relative Values



BW FOIA CBP 003482